CONTENTS

Scheduled Meetings of Interest

American Society for Public Administration Regional Conferences:
    September 20-22, Norfolk, Virginia; September 21-23, Dearborn,
    Michigan; October 5-7, Albany, New York; October 6-7, Des Moines,
    Iowa; October 17-20, Charleston, South Carolina; November 30 -
    December 1, Washington, D.C. Contact your area ASPA Chapter for
    details.

Academy for Management 38th Annual Meeting in San Francisco, Cali-
    fornia, August 9-13. The Academy has an active "R&D/Technology/
    Innovation Management Interest Group."

Conference for the Advancement of Research 32nd Annual Meeting in
    Biloxi, Mississippi, September 24-27.

Society of Research Administrators 12th Annual Meeting in Boston,
    Massachusetts, November 5-8.

Schedule of Meetings - T. W. Edminster

July 21 (PM)   - Annual Leave
- August 7

August 22-24   - Deputy Directors Staff, Room 3109 - South
                    Building, Washington, D.C.

August 28-30   - National Association Conservation Districts
                    Research Committee, Greenville, Mississippi.

September 19-21 - GE International Symposium "Science, Invention
                    and Social Change, Schenectady and Albany,
                    New York.

September 30   - Morrison Lecture, New Orleans, Louisiana.

Chester Cotton, technical editor of the SEA-FR Management Review
for the last two issues, has returned to his teaching responsibilities
at California State University, Chico. We appreciate his many contri-
butions to the Review, and wish him the best of luck. Debra Burrington
and Dick Fraser have worked as technical editors for this issue.

Beginning with this issue, the Management Review will be 3-hole punched
to facilitate its use as a reference source.

An Interview With T. W. Edminster

Management Review: As Federal Research emerges from the reorganization, what do you see as the main impact upon our managers, in the areas and in the regional offices?

T. W. Edminster: I think we are going to see increasing emphasis over the next 6 months to a year on ways to increase and strengthen the interactions that our region and area offices have with our state experiment station cooperators and with our extension programs. They are going to be finding mechanisms for getting more input from them as to program needs and problems. At the same time, we hope that we can give them an increased understanding of some of the concepts of strong basic research programs and long-term programs to meet needs down the road 10 - 15 years from now.

M.R.: If the "tax payer's revolt," signaled by the passing of Proposition 13 in California, spreads to the nation, how severe do you believe the impact on Federal Research budgets might become?

T.W.E.: There's no good way to predict this. Since research and extension are among the discretionary agencies in both the State and Federal systems, undoubtly there is going to be some impact on our research and extension programs---simply because the reduced tax revenues must first support the services that people demand. But it is my feeling that some of these losses may be won back rather quickly as leaders recognize that the future must be supported by research.

M.R.: What are your impressions of the state of Soviet agricultural research?

T.W.E.: As with many other things that we see when we are working with the Soviets, Soviet research is a study in contrasts. It ranges all the way from some rather primitive types of studies to some of the most highly sophisticated studies. This seems to be true almost across all areas of agricultural research. However, I think that in time they are going to be able to strengthen their programs. This is one of the reasons they are working closely with us and with other developed nations. Probably as they improve their internal communication, and as they strengthen their own management techniques, they will be able to bring the level of their research up closer to that of other developed nations.

M.R.: There has been a good bit of comment in the press and also in the scientific literature about the U.S. representatives to the Joint Coordinating Committee on Research on Fundamental Properties of Matter. These physicists have withdrawn from scientific exchanges with Soviet scientists in protest over what the Committee sees as repressive actions by the Soviet government against dissident Soviet scientists. Do you think that agricultural scientists may follow the lead of these U.S. representatives?

T.W.E.: Well, at this time I don't see any evidence of this happening. Agricultural scientists have traditionally been less politicized than some of the

other branches of science. Consequently, there is a common bond between Soviet and U.S. scientists to move ahead and find ways to improve our capability of producing food and fiber to meet world needs. This common objective may be enough to keep these scientists working together.

M.R.: Reflecting upon your years with the agency, in which activities that you had an opportunity to influence do you take most pride?

T.W.E.: Frankly, I don't have an answer to that. After all, agricultural research has been a team program over the years. There have been so many inputs from all levels of the organization---from the scientists on up to the management and the program levels. I think the main thing is that we take pride in the fact that we are all working toward the solutions for some common problems, and that no one of us can take a great deal of pride out of any individual activity.

M.R.: When do you think the next major Federal Research breakthrough will come?

T.W.E.: This is another one that is difficult to answer. If we knew where those breakthrough might come, I'm sure we would be placing greater emphasis on them. Each week, we find some small gain, some small breakthrough in so many different areas, and to say that this is where a major breakthrough is going to come I think is almost beyond the capability of anyone judging.

M.R.: What areas of management do you believe the agency needs to improve? Where do you see that we need to do a better job?

T.W.E.: Well, in FR, we are continuing to look at our program review techniques, looking at the evaluation of programs, and at better ways to judge how we can adjust our programs to get a better cost benefit ratio. We try to better support our scientists keeping our eye on the long-term goals and determining how we can best meet those goals.

M.R.: In view of the reorganization of SEA, does the present structure of the agency in four regions still make sense?

T.W.E.: By all means. When we adjusted our organizational structure in 1972, there were some very specific objectives. One was to bring management closer to our scientists so that we didn't have the long lines of communication between the scientists and headquarters which at that time was totally in Beltsville. The second objective was to strengthen our cooperative relations with our state extension and experiment station people and also with the industry. Here again, this objective is just as important under the SEA organization as it was under the ARS organization. Certainly, since these are common objectives to both the old and the new, I can't help but feel that our regional and area structure is going to be one of the keystones upon which SEA becomes strong.

R&D in the Federal Budget: Third Annual Colloquium on R&D Policy, Sponsored by the Committee on Science, Engineering, and Public Policy:

Purpose of the Session

This session was designed to examine research and development activities and the financing of these activities. The session was divided into three general areas for discussing R&D. They were: Federal R&D, R&D in industry, and R&D and the economy. There was also a discussion of R&D and international economic competition. Speakers at the colloquium included: Frank Press, Director, Office of Technology and Policy, Executive Office of the President; W. Bowman Cutter, Executive Associate Director for Budget, Office of Management and Budget; John C. Sawhill, President, New York University; the Honorable Russell W. Peterson, Director, Office of Technology Assessment, and member AAAS Board of Directors; Wesley A. Kuhrt, Vice President, Technology, United Technologies Corporation; Edward E. David, Jr., President, Exxon Research and Engineering Company, President AAAS, former Presidential Science Advisor; Stan Ruttenberg, President, Ruttenberg, Friedman, Kilgallon, Gutchess, and Associates; Arthur M. Bueche, Vice President, Research and Development, General Electric Company; Jordan Baruch, Assistant Secretary for Science and Technology, Department of Commerce; Robert A. Charpie, President, Cabot Corporation; and George S. Lockwood, General Partner, Monterey Abalone Farms. These speakers along with the panel of inquiry, commentators, and discussion from the audience enabled the colloquium to achieve its intended purpose of providing a forum for constructive discussion of current issues in Federal and industry R&D and the impact of R&D on the economy.

Frank Press pointed out that R&D is literally hundreds of topics and that R&D budgeting is an annual process which does not fit the life cycle of most R&D demands. He stressed the need for broader guidelines for long-range R&D activities. These guidelines should be consistent with cohesive planning and appropriate funding. There is also need for a better monitor of input and output which would include not just dollars and patents but a qualitative measure of output from R&D. "We have the common question of how much is enough. How does one terminate an R&D effort once it has started and has established a supporting clientele?" There is a very serious question of the government's role in R&D, especially when the government is the principle procurer of the results of R&D. He also cited the manpower problems associated with R&D--the supply and demand impact on societies, universities, and individuals. The question of obsolecence associated with R&D, both, equipment and personnel, is a serious problem. He indicated that we alleviate some of these problems by sharing them. He cited action in certain foreign countries where they had created professorships at the universities to be filled by promising R&D personnel. These were joint efforts between government, industry, and universities. There is need for innovative ideas to bring industry and the university into a meaningful partnership in this country. A relatively new concern is the constant change in leadership in Congress and in industry. Some of these leaders come up to speed quickly. Others

take longer. He expressed his support for basic research and initiatives and called for Congressional action. He also indicated that research is a national priority, but he did not discuss priorities between research areas.

Bowman Cutter indicated that OMB will insist upon ranking R&D efforts. This ranking will be examined in detail with preference given first to basic research activities and second to the agency's mission. They will attempt to bring these two items together for a total R&D picture. He sees some deemphasis of the role of "development" in government R&D. Concern was expressed about the course of basic R&D research expenditures in private industry. There is a need to identify what is happening and what to do about it, since there appears to be a broad decline in industry R&D expenditures. Concern was also expressed about the Federal Government policy toward R&D. Cutter sees a tilt toward basic research and at the same time a tilt away from development. This exists because of questions about the place of private industry in development. They view basic research as a public good--thus it ought to be public financed and have public availability. However, government is not the best performer in the area of development. Government must avoid replacing the role of the private sector in basic research. Cutter also pointed out that government has a great deal of trouble assessing consumer demand for products.   He stressed that we are moving toward a multi-year budget. That is a three year budget decision process. The publication of the 1980 budget will reflect this three year effort. It has some problems, however, in that it limits future descretion and people are much less serious about future budgets. He also indicated that OMB will require cross agency as well as within agency ranking around specific selected areas of R&D. He indicated that he sees the need for restrained budgeting and he asked the group for support of this position.

John Sawhill expressed concerns which some of his colleagues have about the current budget for R&D. First, the budget for basic research is not adequate--the five percent proposed will only provide equipment. Second, it is difficult to frame basic research into the ZBB process even with a three year planning horizons. He indicated the need to develop a means of explaining the necessity for new discovery and the application period required to bring about the discovery. Third, recognize that the university and private industry must work in a cooperative fashion. He suggested the possibility of encouraging consortium arrangements for areas of work between basic research and commercial application. He described it as a "no mans land" and said there is need for structure as well as funds to settle this area. Fourth, it is very important to keep our industry competitive with other industries in the world. Research is needed to accomplish this and universities can help.

Russell Peterson indicated that R&D is a means to an end not an end in itself. He used some examples to demonstrate that success of technology assessment depends upon the openess of discussion among the many persons concerned with the results. These deliberations must concern alternative technology or alternative policy to solve a problem. The goal is to solve the problem in a socially acceptable framework, and this requires the use of both technological means and public policy means to accomplish the end. He urged the group to develop strategies so that we can use science and technology to achieve societal goals of the nation.

R&D in Industry

This discussion was expanded to "R&D and Innovation in Industry." Industry people say R&D is just the beginning. The innovation is the commercialization of the reseach development so that it can be delivered to the ultimate user. The speakers indicated that there was no shortage of R&D money. However, less is being done with it. There are two main reasons for this: (1) money cost and tax implications have caused short term strategies to be chosen which bring returns more quickly, and (2) regulations which make the life of new R&D innovations most unpredictable. The thread of the discussion suggested that time is a common denominator--years or at times even decades are involved in successful R&D. Knowledge building is expensive. This discussion also indicated that much information is available about inputs but much less information is available about the payoff for R&D. The health of industrial research and development depends upon a market for it. "If there is no market, there will be no industrial R&D." There was some belief that government funding for R&D may tend to drive out private money. There was some discussion of the present and possible future roles of Federal Government in stimulating industrial innovation. One interesting statement is that "research and development is a discretionary decision within a specific company or specific industry." Within the economy of the country, however, it is not a discretionary decision but rather a mandatory one. There was also some concern about government intervention--the increased paperwork that it required, the rulemaking activities causing enormous hidden costs, and absolute restraints on certain activities.

The colloquium reached the concensus that there is need for additional R&D efforts. There was not complete agreement about the appropriate interaction between the role of government and the role of industry. The universities were identified first with government, then with industry, and sometimes in between.

Charles Beer
Acting Head
Current and Future Priorities Staff
SEA-USDA

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Legislative Report

Since our last report for <u>Management</u> <u>Review</u> there have been some
key developments on the Hill worthy of note.

On June 13, 1978 the Agriculture appropriations bill for FY 78 was
reported by the House Committee on Appropriations. On June 22, 1978,
the House by a vote of 326 yeas to 59 nays passed H.R. 13125 without
any amendments affecting the SEA appropriation. The bill restores
many of the reductions provided for in the FY Executive Branch Budget.

The Subcommittee on Department Investigations, Oversight, and
Research of the House Committee of Agriculture held a joint hearing
with the Subcommittee on Science, Research and Technology of the
House Science and Technology Committee on a bill "To establish a research
and development effort resulting in the commercialization of native
latex rubber". The hearing occurred on June 19 and the Department's
position was presented by Mr. Dave Unger, the Acting Deputy Assistant
Secretary for Conservation, Research, and Education. Copies of the
testimony may be obtained by calling 202-447-3455.

We have recently been asked to provide items for inclusion in the
Department's Legislative Program for the 96th Congress 1st Session.
If you have any suggestions please provide them as soon as possible
through you Acting RDA or directly to this office. The Senate has
recently passed a bill, which was included in the program in the past,
to authorize the Secretary of Agriuclture to retrocede exclusive legis-
lative jurisdiction over lands or interests under his control.

Many of you may have already received a copy of our new report detailing
the status of legislation of interest. If you have any particular bill
you would like us to track for you in this report please give us a call
and we will be pleased to add it to the list.

On the next two pages, you will find a "Status of Legislation" report.
The <u>Management</u> <u>Review</u> will include this report, providing an overview
of legislation that is of interest to SEA. Your suggestions, con-
cerning additional legislation to be monitored, are appreciated.

                                        --W. D. Ladd

x Scheduled
✓ In Process
● Completed

KEY ISSUES	HR Bill No.	Committee	Sub-Committee	Hearings	Reported	Debate	Rejected	Passed	Department Report	S Bill No.	Committee	Sub-Committee	Hearings	Reported	Debate	Rejected	Passed	Department Report	Final Action
APPROPRIATIONS																			
AGRICULTURE 1979	13125	A	1	●	●	●		●			A	1	●						
INTERIOR 1979	12932	A	2	●	●						A	2	●						
LEGISLATIVE PROGRAM																			
EXCLUSIVE JURISDICTION (Ag 951-72)	13348	Ag	5	X					SEA ●	2946	Ag		●	●				●	SEA ●	
VOLUNTEER SERVICES (Ag 951-73)																			
SCIENTIST PROTECTION (Ag 951-124)																			
FARM BILL AMENDMENT (Ag 952-49)																			
MISCELLANEOUS																			
MATERIALS POLICY	10859	S	2	●															
RECOMBINANT DNA	11192	IFC/S		●	●				SEA ✓										
GUAYULE RESEARCH	5720 12559	S/Ag	2/5	●					SEA ●										
GUAYULE RESEARCH										1816	C		●	●	●			●	SEA	
PATENT POLICY	8596 6249								SEA ●										
RENAME CLAY CENTER	6358	Ag	5	●					SEA ●	409	Ag								SEA ●	
RENEWABLE RESOURCES RESEARCH	11778	Ag	5		●	●		●	FS ●	3034	Ag			●	●			●	FS ●	P.L. 95-307

HOUSE COMMITTEES

A — Appropriations
1. Agriculture, Rural Development, and Related Agencies
2. Interior
Ag — Agriculture
1. Conservation and Credit
2. Forests
3. Dairy and Poultry
4. Cotton
5. Department Investigations, Oversight, and Research
6. Domestic Marketing Consumer Relations and Nutrition
7. Family Farms, Rural Development, and Special Studies
8. Forests
9. Livestock and Grains
10. Oilseeds and Rice
11. Tobacco
BFU — Banking, Finance, and Urban Affairs

B — Budget
E — Education and Labor
GO — Government Operations
INT — Interior and Insular Affairs
1. Energy and the Environment
2. Mines and Mining
3. Water and Power Resources
4. Indian Affairs and Public Lands
IR — International Relations
IFC — Interstate and Foreign Commerce
1. Consumer Protection and Finance
2. Energy and Power
3. Health and the Environment
4. Transportation and Commerce
J — Judiciary
MMF — Merchant Marine and Fisheries

4. Fisheries and Wildlife Conservation and the Environment
PO — Post Office and Civil Service
PW — Public Works and Transportation
1. Water Resources
S — Science and Technology
1. Domestic and International Scientific Planning Analysis and Cooperation
2. Science Research and Technology
3. Advanced Energy Technologies and Energy Conservation Research, Development, and Demonstration
4. Environment and the Atmosphere
WM — Ways and Means

SENATE COMMITTEES

A — Appropriations
1. Agriculture and Related Agencies
2. Interior
Ag — Agriculture, Nutrition, and Forestry
1. Environment, Soil Conservation, and Forestry
2. Agricultural Credit and Rural Electrification
3. Agricultural Production Marketing and Stabilization of Prices
4. Agricultural Research and General Legislation
5. Rural Development
6. Foreign Agricultural Policy
7. Nutrition
BHU — Banking, Housing, and Urban Affairs

B — Budget
C — Commerce Science and Transportation
1. Science Technology, and Space
2. Consumer
E — Energy and Natural Resources
1. Energy Research and Development
2. Public Lands and Resources
EPW — Environment and Public Works
1. Environmental Policy
2. Water Resources
F — Finance
FR — Foreign Relations
GA — Governmental Affairs
HR — Human Resources
J — Judiciary

SCIENCE AND EDUCATION ADMINISTRATION
AS OF July 21, 1978

Legend:
- ✓ Scheduled
- ✓ In Process
- ● Completed

KEY ISSUES	HOUSE									SENATE									F A(
	HR Bill No.	Committee	Sub-Committee	Hearings	Reported	Debate	Rejected	Passed	Department Report	S Bill No.	Committee	Sub-Committee	Hearings	Reported	Debate	Rejected	Passed	Department Report	
MISCELLANEOUS																			
RENEWABLE RESOURCES EXTENSION	11779	Ag	5		●	●		●	SEA ●	3035	Ag			●	●		●	SEA ●	P. 95-

Is SEA-FR A Latent Matrix? An Assessment of
Structural and Behavioral Dimensions

by

Gano S. Evans*

Background and Purpose

Last year, several SEA-FR managers expressed interest in exploring the matrix
form of organization and management. It was believed that the SEA-FR structure
could be viewed as a matrix organization; and, that formal adoption of the
matrix form might offer an improved, unified approach to the achievement of the
mission of the Federal Research Component of SEA.

A formal research project was designed to test the degree to which SEA-FR is
viewed as a matrix organization by the Research Leader in the critical position
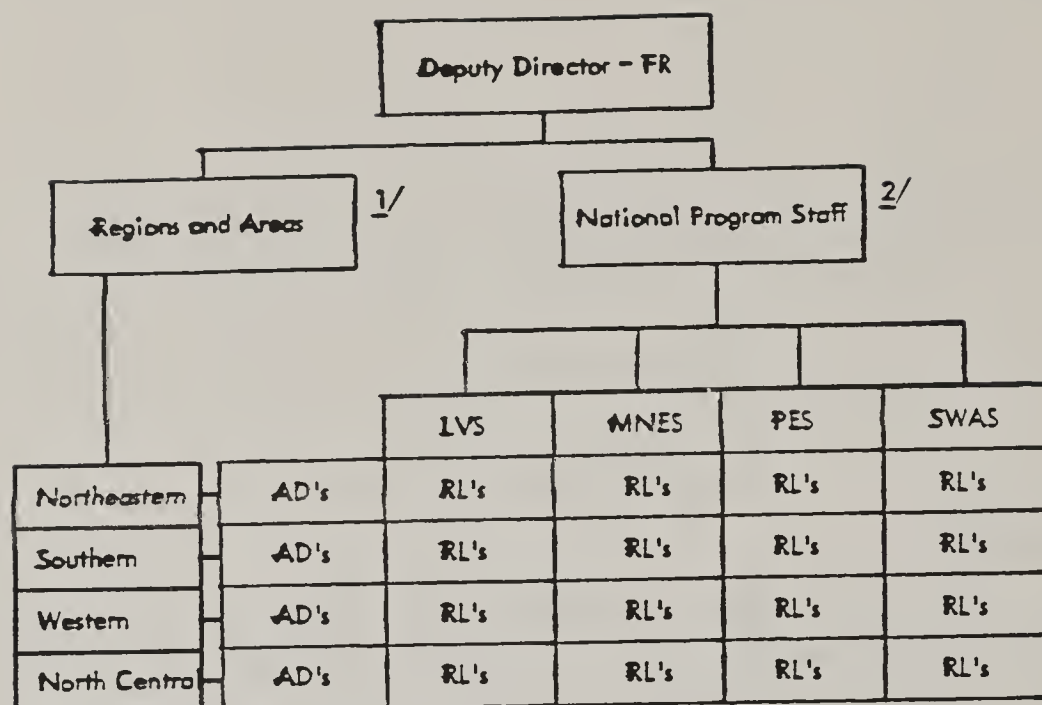of first level supervisor of scientists.

Development of a Conceptual Framework-Structural Dimension

The applicability of the matrix form to the SEA-FR environment was first assessed
by analysis of the literature in this area. (Galbraith, 1973 and 1977; Goggin,
1974; Sayles, 1976; and Lawrence, Kolodny, and Davis, 1977)

The next link in the analytical chain was to pinpoint the place in the organi-
zation where the workflows initiated by systems (Regions/Area) and functional
(NPS) managers converge, i.e., what position is expected to achieve coordination
of system-geographic and functional-NPS workflows? In SEA-FR, the Research
Leader (RL) is the person occupying this critical position of coordination. In
practice, the RL often experiences conflict between the collegial role model used
when dealing with peer scientists and the more conventional role model used to
accomplish the administrative functions assigned to the RL position.

The final test for applicability of the matrix form to the Agency was to concep-
tually convert the SEA-FR line-staff structure to matrix organizational
schematics. That organizational chart follows:

Deputy Director - FR

- Regions and Areas 1/
- National Program Staff 2/

		LVS	MNES	PES	SWAS
Northeastern	AD's	RL's	RL's	RL's	RL's
Southern	AD's	RL's	RL's	RL's	RL's
Western	AD's	RL's	RL's	RL's	RL's
North Central	AD's	RL's	RL's	RL's	RL's

Abbreviations:

AD's — Area Directors
RL's — Research Leaders
LVS — Livestock and Veterinary Sciences
MNES— Marketing Nutrition and Engineering Sciences
PES — Plant and Entomological Sciences
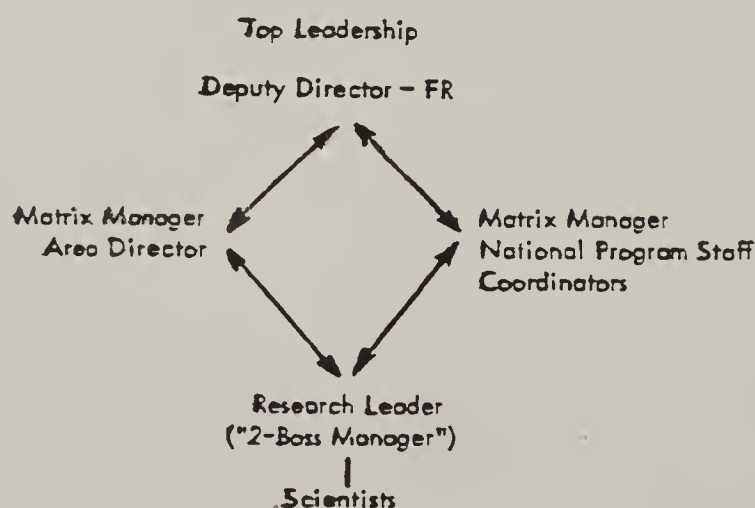SWAS— Soil, Water and Air Sciences

1/ Analogous to "Businesses," "Systems"

2/ Analogous to "functions" or "products"

Source: Adapted from (Goggin, 1974)

At this point, the congruity of the matrix concept with the Agency's perceived environment was informally pretested on a variety of managers in SEA-FR headquarters. Structurally, the matrix form was congruent with the SEA-FR organization.

Assessment of Behavioral Dimensions

From the analysis of structural dimensions it was possible to frame a specific research question: Does the SEA-FR line-staff structure operate in practice as a matrix with the Research Leader (RL) in the critical position of the "2-Boss Manager"--the first level supervisor of scientists? This role has been pictorially represented as follows:

Top Leadership

Deputy Director - FR

Matrix Manager
Area Director

Matrix Manager
National Program Staff
Coordinators

Research Leader
("2-Boss Manager")

Scientists

Source: Adapted from (Lawrence, Kolodny, and Davis, 1977)

In order to answer the research question, a methodology was developed for a field study of Research Leaders to test the following hypothesis:

H_1: Research Leaders will see themselves as "2-Boss Managers" because their own resource usage is controlled by a dual hierarchy made up of the Area Director and the relevant National Program Staff Coordinators.

FIELD STUDY

Methodology

A semistructured personal interview schedule was completed with 26 RL's in the Arizona-New Mexico and California-Hawaii-Nevada Areas in September, 1977, and March, 1978, respectively. The interviews were designed to provide a test of H_1 by determining which of 23 formally designated functions were viewed as more important by RL's and the nature of RL interfaces with other Agency personnel in performing those functions.

It was important that bias not be introduced in the interview by any researcher reference to specific positions or people, e.g., Area Director or National Program Staff. RL's were asked to tell about critical incidents when they felt most effective and/when they felt most frustrated in their jobs. The incidents, per se, were analyzed to determine how and with whom the RL worked during the incidents.

Results

Even though the sample size was small, the interfaces described by RL's provided no evidence of a formal matrix because not one RL described himself in the explicit role of "2-Boss Manager." Some of the interfaces described by RL's would fit comfortably into the traditional line-staff model.

An amazing number of incidents were described in which RL's who had been most successful in resolving the critical needs of their scientists for funds and recognition tended to ignore the hierarchical nature of the Agency almost entirely. Instead, they saw influential persons as an undifferentiated group of sponsors who had to be convinced to support the unit's need. In many cases the Area Director was viewed as just another sponsor--and not necessarily the most important one. In terms of the previous schematic form, the RL perception of the organization would be:
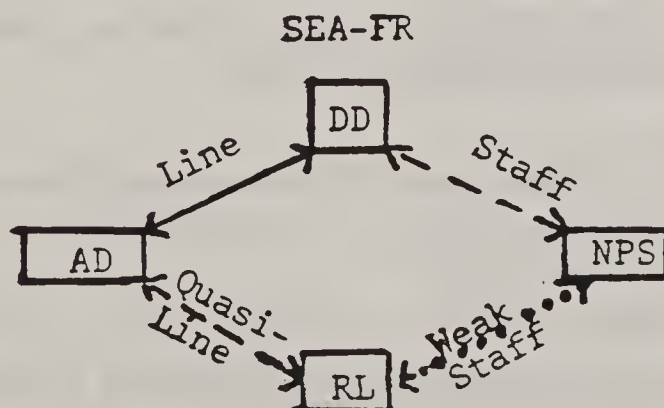
SEA-FR

The article in this issue of the <u>SEA/FR Management Review</u> entitled "Problems of Matrix Organizations" diagnoses one of the ills of the matrix as a "tendency toward anarchy" which, at its worst, is described as·

    "A formless state of confusion where people do not recognize a 'boss' to whom they feel responsible." (Davis & Lawrence, 1978)

Certainly the findings of this study <u>do</u> <u>not</u> suggest that SEA-FR is about to come apart at the seams. Instead SEA-FR should be classified as a "Latent" matrix where critical tasks are coordinated on an informal basis so that people are in approximate agreement about who is to do what under various circumstances. (Davis & Lawrence, 1978)

Conclusion

If the organization is satisfied that the SEA-FR mission is best achieved as a latent matrix--which may well be true--there is no compelling reason to change the present state of the organization.

On the other hand, if top management concludes that the SEA-FR mission would be better achieved by formal adoption of the matrix form, than roles and relationships for the actors in the system must be made explicit. In SEA-FR, the matrixed managers would be RL's, AD's, and NPS Coordinators who would need to develop and clarify their own roles in relation to each other. It should be remembered that although the matrix form provides an alternative design to cope with demands of increasing complexity, it is a definite structure and not a "free form" organization.

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Problems of matrix organizations

Matrix design has many benefits, but to reap them managers need to know how to prevent and treat its problems

Stanley M. Davis and Paul R. Lawrence

No company is completely free of organization problems, and companies that use the matrix form are no exception. Some of the ailments matrix organizations suffer, such as power struggles and collapse during an economic crunch, other companies suffer as well. But many of the problems a matrix organization falls prey to occur because of the nature of the matrix design itself. For instance, it is not difficult to understand how managers in a matrix organization, where there are dual chains of command, might develop too little or too much control, thus succumbing to anarchy or decision strangulation. The authors of this article have studied a number of companies employing some form of the matrix and have observed nine different pathologies to which they are particularly vulnerable. Here, they present the pathologies, diagnose why and how they arise in matrix forms, and then prescribe prevention and treatment

measures that matrix managers suffering these ills can take.

No organization design or method of management is perfect. And any form can suffer from a variety of problems that develop because of the design itself. This is particularly true when a company tries a new form. In this article we look at one relatively new organization form—the matrix—which has gained considerable popularity in recent years but which has some significant pathologies. Before discussing its ills, however, let us look for a moment at matrix management and organization (see ruled insert on page 134) and at how widespread the matrix is in U.S. industry today.

The list of well-known companies that are using some form of a matrix is becoming long and impressive. Take, for example, a company that has annual sales of $14 billion and employs about 400,000 people in scores of diverse businesses—General Electric. For decades, despite the diversity of its businesses, GE used one basic structure throughout its organization: five functional managers reporting to one general manager. Employing the logic that a company must organize to meet the particular needs of each business, some GE groups, divisions, and departments, which have found the pyramid form cumbersome, have turned to the matrix as a fundamental alternative.

In projecting its organization over the next ten years, GE management states in its Organization Planning Bulletin (September, 1976):

"We've highlighted matrix organization . . . not because it's a bandwagon that we want you all to jump on, but rather that it's a complex, difficult, and sometimes frustrating form of organization to live with. It's also, however, a bellwether of things to come.

But, when implemented well, it does offer much of the best of both worlds. And all of us are going to have to learn how to utilize organization to prepare managers to increasingly deal with high levels of complexity and ambiguity in situations where they have to get results from people and components *not* under their direct control. . . .

"Successful experience in operating under a matrix constitutes better preparation for an individual to run a huge diversified institution like General Electric—where so many complex, conflicting interests must be balanced—than the product and functional modes which have been our hallmark over the past twenty years."

Other major corporations, in diverse activities, such as Bechtel, Citibank, Dow Chemical, Shell Oil, Texas Instruments, and TRW, to mention a few, have also turned to the matrix. Based on our studies of the matrix in these companies, we believe that while some of the matrix's popularity is simply a passing fad, most uses of it are founded on solid business reasons that will persist. The matrix's most basic advantage over the familiar functional or product structure is that it facilitates a rapid management response to changing market and technical requirements. Further, it helps middle managers make trade-off decisions from a general management perspective.

Because the matrix is a relatively new form, however, the companies that have adopted it have of necessity been learning on a trial and error basis. The mistakes as well as the successes of these pioneers can be very informative to companies that follow their lead. Here, we present some of the more common problems that occur when a company uses a matrix form. For the sake of easy reference, we diagnose each pathology first, then discuss its prevention and treatment. By using this format, however, we do not mean to suggest that simple first-aid treatment of pathologies will cure them.

Ills of the matrix

Many of the ailments we discuss do arise in more conventional organizations, but the matrix seems somewhat more vulnerable to these particular ones.

It is wise, therefore, for managers thinking of adopting a matrix to be familiar with the diagnoses, prevention, and treatment of nine particular pathologies: tendencies toward anarchy, power struggles, severe groupitis, collapse during economic crunch, excessive overhead, sinking to lower levels, uncontrolled layering, navel gazing, and decision strangulation.

Tendencies toward anarchy

A formless state of confusion where people do not recognize a "boss" to whom they feel responsible.

Diagnosis—Many managers who have had no firsthand familiarity with matrix organizations tend to have half-expressed fears that a matrix leads to anarchy. Are these concerns based on real hazards? Actually today, a considerable number of organizations are successfully using the matrix form, so we need not treat anarchy as a general hazard of the matrix. However, there are certain conditions or major misconceptions that could lead a company into the formless confusion that resembles anarchy.

Through firsthand experience we know of only one organization that, using a "latent" matrix form, quite literally came apart at the seams during a rather mild economic recession. Following a fast-growth strategy, this company used its high stock multiple to acquire, and then completely assimilate, smaller companies in the recreation equipment field. Within a period of about six months the company changed from an exciting success to a dramatic disaster. Its entire manufacturing, distribution, and financial systems went out of control leaving unfilled orders, closed factories, distressed inventories, and huge debts in their wake.

Of course, there are many possible reasons why this might have happened, but one perfectly reasonable explanation is that the organization design failed under stress. What was that design?

Essentially, the organization used a functional structure. As it acquired each small company, top management first encouraged the owners and general managers to leave, and then it attached the company's three basic functions of sales, production, and engineering to their counterparts in the parent organization. Within the parent marketing department, a young aggressive product manager would be assigned to develop for the acquired product line a comprehensive marketing plan that included mak-

ing sales forecasts, promotion plans, pricing plans, projected earnings, and so forth. Once top management approved the plan, it told the selected product manager to hustle around and make his plan come true. This is where the latent matrix came in.

The product manager would find himself working across functional lines to try to coordinate production schedules, inventories, cash flow, and distribution patterns without any explicit and formal agreements about the nature of his relationships with the functional managers. Because he was locked into his approved marketing plan, when sales slipped behind schedule, his response was to exhort people to try harder rather than to cut back on production runs.

But once one or two things began to crumble, there was not enough reserve in the system to keep everything else from going wrong. As the product manager lost control, a power vacuum developed, into which the functional managers fell, each grabbing for total control. The result was that a mild recession triggered conditions approaching anarchy.

Prevention—We believe the lesson of this experience is loud and clear. Organizations should not rely too much on an informal or latent matrix to coordinate critical tasks. Relationships between functional and product managers should be explicit so that people are in approximate agreement about who is to do what under various circumstances. Properly used, a matrix does not leave such matters in an indefinite status; it is a definite structure and not a "free form" organization.

A useful "anarchy index" is how many people in an organization do not recognize one boss to whom they feel responsible for a major part of their work. In a study of five medical schools, which are notoriously anarchical, the one with the most explicit matrix structure was also the one with the least number of "bossless" people.[1]

Treatment—Should the worst happen and a company plunge into anarchy, true crisis management would be the best response. The crisis response is really no mystery. The CEO must pull all key people and critical information into the center. He or she must personally make all important decisions on a round-the-clock schedule until the crisis is over. Then and only then can he undertake the work of

1. From the forthcoming article by M.R. Weisbord, M.P. Charns, and P.R. Lawrence, "Organizational Dilemmas of Academic Medical Centers," *Journal of Applied Behavioral Science*, Vol. XIV, No. 3.

What is a matrix?

The identifying feature of a matrix organization is that some managers report to two bosses rather than to the traditional single boss; there is a dual rather than a single chain of command.

Companies tend to turn to matrix forms:

1 when it is absolutely essential that they be highly responsive to two sectors simultaneously, such as markets and technology;
2 when they face uncertainties that generate very high information processing requirements; and
3 when they must deal with strong constraints on financial and/or human resources.

Matrix structures can help provide both flexibility and balanced decision making, but at the price of complexity.

Matrix organization is more than a matrix structure. It must be reinforced by matrix systems such as dual control and evaluation systems, by leaders who operate comfortably with lateral decision making, and by a culture that can negotiate open conflict and a balance of power.

In most matrix organizations there are dual command responsibilities assigned to functional departments (marketing, production, engineering, and so forth) and to product or market departments. The former are oriented to specialized in-house resources while the latter focus on outputs. Other matrices are split between area-based departments and either products or functions.

Every matrix contains three unique and critical roles; the top manager who heads up and balances the dual chains of command, the matrix bosses (functional, product, or area) who share subordinates, and the managers who report to two different matrix bosses. Each of these roles has its special requirements.

Aerospace companies were the first to adopt the matrix form, but now companies in many industries (chemical, banking, insurance, packaged goods, electronics, computer, and so forth) and in different fields (hospitals, government agencies, and professional organizations) are adapting different forms of the matrix.

reshaping the organization so that it can withstand any future shock such as a minor recession.

Power struggles

Managers jockey for power in many organizations, but a matrix design almost encourages them to do so.

Diagnosis—The essence of a matrix is dual command. For such a form to survive there needs to be a balance of power, where its locus seems to shift constantly, each party always jockeying to gain an advantage. It is not enough simply to create the balance, but there must also be continual mechanisms for checking the imbalances that creep in.

In business organizations that operate with a balance of power form, there is a constant tendency toward imbalance. As long as each group or dimension in an organization tries to maximize its own

advantage vis-à-vis others, there will be a continual balancing struggle for dominant power. A power struggle in a matrix is qualitatively different from that in a traditionally structured hierarchy because in the latter it is clearly illegitimate. In the matrix, however, power struggles are inevitable; the boundaries of authority and responsibility overlap prompting people to maximize their own advantage.

Prevention—Most top managers will find it exceedingly difficult to forestall all power struggles. Equal strength on the part of the two parties, however, will prevent struggles from reaching destructive heights. Friendly competition should be encouraged, but all-out combat severely punished. Managers in a matrix should push for their advantages but never with the intention of eliminating those with whom they share power, and always with a perspective that encompasses both positions.

Treatment—The best way to ensure that power struggles do not undermine the matrix is to make managers on the power axes aware that to win power absolutely is to lose it ultimately. These managers need to see that the total victory of one dimension only ends the balance, finishes the duality of command, and destroys the matrix. They must see this sharing of power as an underlying principle, before and during all of the ensuing and inevitable power struggles.

Matrix managers have to recognize that they need worthy adversaries, counterparts who can match them, to turn the conflict to constructive ends. For this successful outcome three things are necessary.

First, matrix managers always have to maintain an institutional point of view, seeing their struggles from a larger, shared perspective. Second, they have to jointly agree to remove other matrix managers who, through weakness or whatever inability, are losing irretrievable ground. And, third, that they replace these weak managers with the strongest available people—even if to do so means placing very strong managers in weakened parts of the organization and reversing their power initiatives.

Another key element in stopping power struggles before they get out of hand and destroy the balance is the top level superior to whom the duelling managers report. Because of this element, the matrix is a paradox—a shared-power system that depends on a strong individual, one who does not share the authority that is delegated to him (say by the board), to arbitrate between his power-sharing subordinates.

The top manager has many vehicles for doing this: the amount of time he spends with one side of the matrix or the other, pay differentials, velocity of promotion, direct orders issued to one dimension and not to the other, and so forth. What he must do above all, however, is protect the weak dimension in the organization, not necessarily the weak manager in charge of that dimension.

Severe groupitis

The mistaken belief that matrix management is the same as group decision making.

Diagnosis—The confusion of matrix behavior with group decision making probably arises from the fact that a matrix often evolves out of new project or business teams, which do suggest a group decision process. Under many circumstances, of course, it is perfectly sensible for managers to make decisions in groups. But managers should expect difficulties to arise if they believe group decision making to be the essence of matrix behavior.

We have seen one matrix organization that had a severe case of "groupitis." This multiproduct electronics company had a product manager and a product team, comprised of specialists drawn from the ranks of every functional department, assigned to every product. So far so good. But somehow the idea that the matrix structure requires that *all* business decisions be hammered out in group meetings became prevalent in the organization. To make decisions in other ways was considered illegitimate and not in the spirit of matrix operations.

Many of the decisions that had to be made about each product involved detailed matters with which only one or two people were regularly conversant. Yet all team members were constrained to listen to these issues being discussed until a decision was made, and were even expected to participate in the discussion and influence the choice. Some individuals seemed to enjoy the steady diet of meetings and the chance to practice being a generalist.

However, a larger number of people felt that their time was being wasted and would have preferred leaving the decisions to the most informed people. The engineers, in particular, complained that the time they were spending in meetings was robbing them of opportunities to strengthen their special competence and identities. As well as noting these personal reactions, senior managers reported a gen-

eral disappointment with the speed and flexibility of organizational responses.

Prevention—Because the whole idea of a matrix organization is still unfamiliar to many managers, it is understandable that they confuse it with processes such as group decision making. The key to prevention is education. Top managers need to accompany their strategic choice to move toward a matrix with a serious educational effort to clarify to all participants what a matrix is and what it is not.

Treatment—In the case of the multiproducts electronics company, the problem came to light while we were researching the matrix approach. Once senior people had clearly diagnosed the problem, it was 90% cured. Top management emphatically stated that there was nothing sacred about group decisions and that it was not sensible to have all product team members involved all the time. Once the line between individual and group matters was drawn according to who had information really relevant to a decision, meetings became fewer and smaller and work proceeded on a more economical and responsive basis. The concept of teamwork was put in perspective: as often as necessary and as little as possible.

Collapse during economic crunch

When business declines, the matrix becomes the scapegoat for poor management and is discarded.

Diagnosis—Matrix organizations that blossom during periods of rapid growth and prosperity sometimes are cast away during periods of economic decline. On reflection, we can understand this. In prosperous times, companies often expand their business lines and the markets they serve. The ensuing complexity may turn them toward matrix management and organization.

However, if these companies follow the normal business cycle, there will be a period of two to five years before they experience another economic crunch which is more than enough time for the matrix concept to spread throughout a company. By that time the matrix occupies a central place in company conversations and is a familiar part of these organizations. Although there may still be some problems, the matrix seems there to stay.

When the down part of the economic cycle begins, senior management in these companies may become appreciably bothered by the conflict between subordinates as well as by the apparent slowness with which they respond to the situation. "We need decisive action" is their rallying cry.

In an authoritarian structure top management can act quickly because it need not consider the spectrum of opinion. Thinking there is no time for organizational toys and tinkering, the top level managers take command in an almost, but not quite, forgotten way, and ram their directives down the line. The matrix is "done in."

Prevention—Top management can prevent this kind of collapse of the matrix by employing general managerial excellence, independent of the matrix, long before the crunch arrives. Good planning, for example, can often forecast downturns in the economic cycle. Corporate structures such as the matrix should not have to change because of standard changes in the business cycle. When management planning has been poor, however, the matrix is a readily available scapegoat.

Companies that experience severe economic crunches often make drastic changes in many directions at once: trimming product lines, closing offices, making massive personnel and budget cuts, and tightening managerial controls. The matrix is often done in during this period for several reasons: it represents too great a risk; "it never really worked properly" and giving it the coup de grace can disguise the failure of implementation; and the quality of decision making had not improved performance sufficiently to counterbalance the hard times. Measures management can take to prevent this pathology do not lie within the matrix itself, as much as with improvements in basic managerial skills and planning.

A real estate and construction company provides an example of how a company can anticipate and flexibly respond to an economic crunch that demonstrates the strength rather than the weakness of the matrix. The company has developed a structure as well as procedures that are especially well suited to the economic uncertainties of the business. These include a set of fully owned subsidiaries each the equivalent of a functional department in a manufacturing company and each the "home base" for varied specialists needed to execute all phases of a major building project. The heads of the subsidiaries act as chief salesmen for their various services, and and often head up the bidding teams that put together sophisticated proposals.

As a proposal project proceeds, the selected project manager is drawn into the team in anticipation of securing the contract. This ensures an orderly transition to the project management phase. The project office is given first-line responsibility for control of costs, schedules, and quality of the project, but the top management team from the parent company reviews the project regularly as a backup.

The company has used the matrix to advantage in weathering major shifts in both the availability of business by market segment, for example, from schools to hospitals, and the level of construction activity. It maintains a cadre of professional specialists and project managers, who can be kept busy during the lows of the cycle, which it rapidly expands during the highs by subcontracting for temporary services.

Treatment—This is one pathology that requires preventive treatment; we do not know of any cure. When the matrix does collapse during an economic crunch, it is very unlikely that it can be resurrected. At best, the organization will go back to its pendulum days, alternating between the centralized management of the crunch period and the decentralized freedoms of more prosperous times. Even if top management should try again, it is likely to get a negative response from lower level managers. "They said they were committed to the matrix, but at the first sign of hard times all the nice words about the advantages of the matrix turned out to be just that—nice words." If a company's conditioned response to hard times is to retrench, it should not attempt a matrix in the first place.

Excessive overhead

The fear of high costs associated with a matrix.

Diagnosis—On the face of it, a matrix organization would seem to double management costs because of its dual chain of command. This issue deserves thoughtful consideration.

The limited amount of research on matrix overhead costs indicates that in the initial phases overhead costs do in fact rise, but that, as a matrix matures, these extra costs disappear and are offset by productivity gains.[2] Our experience supports this finding. In a large electronics company we observed in some detail how initial overhead increases not only necessarily occur in a matrix but also how they can inflate unnecessarily. In this case, the company decided to employ the matrix design from the outset in setting up its new operating division at a new plant site.

This unique organizational experiment had a number of positive attributes, but one of its problems was with overhead costs. In staffing the new division, top management filled every functional office and every product manager's slot with one full-time person. This resulted in a relatively small division having top level managers as well as full-time functional group and full-time product managers. Within months, however, this top heavy division was pared down to more reasonable staffing levels; by assigning individuals to two or more slots, management got costs under control.

Prevention—The division's problem was caused by top management's assumption that each managerial slot requires a full-time incumbent. Overstaffing is much less liable to occur when an organization evolves gradually from a conventional design into a matrix, and managers perform as both functional and product managers. While this technique can be justified as a transition strategy, it also has its hazards. A safer route is to assign managers roles on the same side of the matrix (i.e., two functional jobs or two product management jobs).

As a final argument against the fear of overhead costs, consider that no well-run organization would adopt a matrix structure without the longer run expectation that, at a given level of output, the costs of operations would be lower than with other organizational forms. In what way can such economies be achieved?

The potential economies come from two general sources: fewer bad decisions and less featherbedding. First and most important, the matrix can improve quality of business decisions because it helps bring the needed information and emphasis to bear on critical decisions in a timely fashion. The second source, less featherbedding, is not so obvious, but potentially of greater significance. How can it work?

Treatment—Perhaps the clearest example of the matrix's potential to reduce redundancies in human resources is the way some consulting organizations employ it. These firms usually set up a matrix of functional specialists against client or account managers. The body of other consultants are grouped with their fellow specialists but are available for

2. C.J. Middleton, "How to Set Up a Project Organization," HBR March-April 1967, p. 73.

assignment to projects under the leadership of account or client managers.

From an accounting standpoint, therefore, consultants' time is directly billed to clients' accounts when they are working for an account or engagement manager. Otherwise, their time is charged against the budget of their function manager. The firm's nonbillable costs are, therefore, very conspicuous—both by department and by individual consultant. Of course, some time charged to functional departments, such as background study, research work, and time between assignments should by no means be thought of as wasted. But management can budget such time in advance so that it can scrutinize the variances from the budget.

As one senior manager in a consulting firm put it, "There is no place to hide in a matrix organization." This fact makes clear-cut demands on middle level people and consequently puts pressure on them to produce. For the long-term good of both the people involved and the organization, top managers need to keep such pressures from becoming too strong. Because it is perfectly possible to get too much as well as too little pressure, a creative tension is sought.

Sinking to lower levels

The matrix has some difficulty in staying alive at high levels of a corporation, and a corresponding tendency to sink to group and division levels where it thrives.

Diagnosis—Sinking may occur for two reasons. Either senior management has not understood or been able to implement the matrix concept as well as lower level managers, or the matrix has found its appropriate place. For example, if a company sets up a matrix between its basic functional and product groups, the product managers never truly relinquish their complete control, and the matrix fails to take hold at the corporate level.

But, say, one or two of the managers find the idea to be useful within their divisions. Their own functional specialists and project leaders can share the power they delegate and the design can survive within subunits of the corporation. For example, Dow Chemical's attempt to maintain the product/geography balance at the top failed, but the function/product balance held within the geographic areas for several years.

When sinking occurs because of top management misunderstanding, it is likely to occur in conjunction with other pathologies, particularly power struggles. For instance, if many senior executives consider adopting the matrix idea, but only one or a few really become convinced of its worth, there is a danger: those at the top who espouse a philosophy and method they did not employ themselves will be pitted against those who are able to show that it does work.

Prevention—If the corporate top management thinks through which dimensions of the company it must balance, and at what level of aggregation, it can keep the matrix from sinking. For example, top managers should ask themselves if all the business units need to be balanced by central functional departments. If the answer is no, then some business units should operate as product divisions with the traditional pyramid of command, while others share functional services in a partial matrix. However, sinking is not always bad and should be prevented only when it indicates that an appropriate design is disintegrating.

Treatment—Before matrix management can run smoothly, it must be in the proper location. As often as not, when a matrix sinks, it may simply be experiencing a healthy adjustment, and ought to be thought of as settling rather than as sinking. Settling is likely to occur during the early stages of a matrix's evolution and leads to manageable matrix units.

The question of size is a great concern for many managers who ask, in effect, "That sounds great for a $250-million company with a few thousand employees, but can it work for a $2-billion or $3-billion company with 50,000 employees? Its entire company is the size of one of our divisions." Our experience indicates that matrix management and organization seems to function better when no more than 500 managers are involved in matrix relationships. But that does not rule out the $2-billion to $3-billion company. In a company of 5,000 only about 50 managers are likely to be in the matrix; so in a company with 50,000 employees only about 500 may need to be involved in dual reporting lines. With that number, the people who need to coordinate regularly are able to do so through communication networks that are based on personal relations.

Whatever the size unit in which the matrix operates, the important thing is for management to have reasoned carefully from an analysis of the task to the design of the organization. Then, if settling oc-

curs, it should be seen not as a pathology but as a self-adjustment that suggests the organization's capacity to evolve with growth.

Uncontrolled layering

Matrices which lie within matrices which lie within matrices result frequently from the dynamics of power rather than from the logic of design.

Diagnosis—Sometimes matrices not only sink but also cascade down the organization and filter through several levels and across several divisions. This layering process may or may not be pathological. In fact, it may be a rational and logical development of the matrix, but we include it briefly here because it sometimes creates more problems than it solves. In terms of the metaphor we have used in this article, layering is a pathology only if the matrix begins to metastasize. When this occurs, organization charts begin to resemble blueprints for a complex electronic machine, relationships become unnecessarily complex, and the matrix form may become more of a burden than it is worth.

Prevention and treatment—The best remedies for uncontrolled layering are careful task analysis and reduced power struggles. We have seen a few cases where one dimension of a matrix was clearly losing power to the other, so, adapting an "if you can't beat 'em, join 'em" philosophy, it created a matrix within its own dimension. A product unit, for example, developed its own functional *expertise* distinct from the functional *units* at the next level up. The best defense was a good offense, or so it seemed.

In two other cases, the international dvisions of two large companies each created its own matrix by adding business managers as an overlay to its geographic format, without reconciling these with the managers who ran the domestic product/service groups. In each case, adequate conceptualization by top managers would probably have simplified the organization design and forestalled the layering, which occurred because of power maneuvers. Management can treat this unhealthy state best by rebalancing the matrix so that no manager of one dimension is either too threatened or pushed too hard toward a power goal.

Matrix design is complex enough without the addition of power struggles. A well-conceptualized matrix is bound to be less complex and easier to manage than one that is illogically organized.

Navel gazing

Managers in a matrix can succumb to excessive internal preoccupation and lose touch with the marketplace.

Diagnosis—Because a matrix fosters considerable interdependence of people and tasks and demands negotiating skills on the part of its members, matrix managers sometimes tend to get absorbed in internal relations at the expense of paying attention to the world outside the organization, particularly to clients. When this happens, an organization spends more energy ironing out its own disputes than in serving its customers. The outward focus disappears because the short-term demands of daily working life have yet to be worked through.

The navel gazers are not at all lethargic; rather they are involved in a heated fraternal love/hate affair with each other. This inward preoccupation is more common in the early phases of a matrix, when the new behaviors are being learned, than in matrices that have been operating for a few years.

Prevention—Whatever other pathologies develop in a matrix, attention to their cure is bound to increase the internal focus of the members; so prevention of other pathologies will certainly reduce the likelihood of this one occurring. Awareness of the tendency will also help. Since the product dimension of the organization generally has a more external focus than the resource dimension, the responsibility for preventing an excessive introspection is not equally distributed. The product dimension people can help the others keep perspective, but a strong marketing orientation is the best preventative of all.

Treatment—If the managers in the matrix are navel gazing, the first step in the treatment is to make these managers aware of the effects. Are customers complaining a lot, or at least more than usual? Managers need to confront internal conflict, but also to recognize that confrontation is secondary to maintaining effective external relationships. Navel gazing generally occurs when the matrix has been fully initiated but not yet debugged. People accept it, but they are engrossed in figuring out how to make it work.

The second step is to treat the inward focus as a symptom of the underlying issue: how to institutionalize matrix relationships so that they become familiar and comfortable routines, and so that people can work through them without becoming obsessed

by them. Finally, it must always be remembered that any form of organization is only a means and should never become an end in itself.

Decision strangulation

Too much democracy, not enough action!

Can moving into a matrix lead to the strangulation of the decision process, into endless delays for debate, for clearing with everybody in sight? Will decisions, no matter how well thought through, be made too late to be of use? Will too many people have power to water down all bold initiatives or veto them outright? Such conditions can arise in a matrix. We have in mind three situations—constant clearing, escalation of conflict, and unilateral style —each calling for slightly different preventive action and treatment.

Constant clearing—In one company we know of, various functional specialists who reported to a second boss, a product manager, picked up the idea that they had to clear all issues with their own functional bosses before agreeing to product decisions. This meant that every issue had to be discussed in at least two meetings, if not more. During the first meeting, the specialists and the product manager could only review the facts of the issue, which was then tabled until, at the second meeting, the specialists cleared the matter with their functional bosses—who by this process were each given a de facto veto over product decisions.

This impossible clearing procedure represented, in our view, a failure of delegation, not of the matrix. One needs to ask why the functional specialists could not be trusted to act on the spot in regard to most product decisions in ways that would be consistent with the general guidelines of their functional departments? Either the specialists were poorly selected, too inexperienced and badly informed, or their superiors were lacking in a workable degree of trust of one another. Regardless, this problem, and its prevention and treatment, needs to be addressed directly without making a scapegoat of the matrix.

Escalation of conflict—Another possible source of decision strangulation in matrix organizations occurs when managers frequently or constantly refer decisions up the dual chain of command. Seeing that one advantage of the conventional single chain of command is that two disagreeing peers can go to their shared boss for a resolution, managers un-

familiar with the matrix worry about this problem almost more than any other. They look at a matrix and realize that the nearest shared boss might be the CEO, who could be five or six echelons up. They realize that not too many problems can be pushed up to the CEO for resolution without creating the ultimate in information overload. So, they think, will not the inevitable disagreement lead to a tremendous pileup of unresolved conflict?

Certainly, this can happen in a malfunctioning matrix. Whether it does happen depends primarily on the depth of understanding that exists about required matrix behavior on the part of managers in the dual structure. Let us envision the following scene: a manager with two bosses gets sharply conflicting instructions from his product and his functional bosses. When he tries to reconcile his instructions without success, he quite properly asks for a session with his two bosses to resolve the matter. The three people meet, but the discussion bogs down, no resolution is reached, and neither boss gives way.

The two bosses then appeal the problem up a level to their respective superiors in each of the two chains of command. This is the critical step. If the two superiors properly understand matrix behavior, they will first ascertain whether the dispute reflects an unresolved broader policy issue. If it does not, they know their proper step is to teach their subordinates to resolve the problem themselves—not to solve it for them. In short, they would not let the unresolved problem escalate, but would force it back to the proper level for solution, and insist that the solution be found promptly.

Often, conflict cannot be resolved; it can, however, be managed, which it must be if the matrix is to work. Any other course of action would represent management's failure to comprehend the essential nature of the design.

Unilateral style—A third possible reason for decision strangulation in a matrix system can arise from a very different source—personal style. Some managers have the feeling they are not truly managing if they are not in a position to make crisp, unilateral decisions. Identifying leadership with decisive action, they become very frustrated when they have to engage in carefully reasoned debates about the wisdom of what they want to do.

Such a manager is likely to feel frustrated even in regard to a business problem whose resolution will

vitally affect functions other than his own, such as in a company that is experiencing critical dual pressure from the marketplace and from advancing technology. A matrix that deliberately induces simultaneous decision making between two or more perspectives is likely to frustrate such a person even further.

If managers start feeling emasculated by bilateral decision making, they are certain to be unhappy in a matrix organization. In such cases the strangulation is in the eye of the beholder. Such people must work on their personal decision-making style or look for employment in a nonmatrix organization.

At last, legitimacy

We do not recommend that every company adopt the matrix form. But where it is relevant, it can become an important part of an effective managerial process. Like any new method it may develop serious bugs, but the experiences that many companies are acquiring with this organization form can now help others realize its benefits and avoid its pitfalls.

The matrix seems to have spread despite itself and its pathologies: what was necessary was made desirable. It is difficult and complex, and human flexibility is required to arrive at organizational flexibility.

But the reverse is also true; success has given the form legitimacy, and, as the concept spreads, familiarity seems to reduce the resistance and difficulties people experience in using the matrix. Managers are now beginning to say, "It isn't that new or different after all." This familiarity is a sign of acceptance, more than of change or moderation of the design.

For generations, managers lived with the happy fiction of dotted lines, indicating that a second reporting line was necessary if not formal. The result had always been a sort of executive ménage à trois, a triangular arrangement where the manager had one legitimate relationship (the reporting line) and one that existed but was not granted equal privileges (the dotted line).

As executives develop greater confidence with the matrix form, they bring the dotted line relationship out of the closet, and grant it legitimacy.

Each time another organization turns to the matrix, it has a larger and more varied number of predecessors that have chartered the way. The examples of wider applicability suggest that the matrix is becoming less and less an experiment and more and more a mature formulation in organization design. As more organizations travel the learning curve, the curve itself becomes an easier one to climb. Similarly, as more managers gain experience operating in matrix organizations, they are bound to spread this experience as some of them move, as they inevitably will, into other organizations.

We believe that in the future matrix organizations will become almost commonplace and that managers will speak less of the difficulties and pathologies of the matrix than of its advantages and benefits.

Federal Policies and Practices Related to R&D/Innovation

Leonard L. Lederman

*This article reviews the results of research on the rationale
for Federal involvement and the effect of regulation of business on
technological innovation.*

As used in this paper, the term "innovation" or "technological innovation" comprises all aspects of the processes of innovation, from conception or generation of an idea to its widespread utilization by society. This includes all activities involved in the creation, research, development, and diffusion of new and improved products, processes, and services for private and public use. In this sense R&D is most frequently a necessary—but not sufficient—condition for innovation (1).

This discussion of the role of the private and public sector in innovation in the U.S. should distinguish between three types of cases:

1. The support for the institutional capability, knowledge base, and scientific, engineering, and technical education is generally accepted in the U.S. as both a public and private responsibility. At this level there is general agreement that government has a clear role especially with regard to education, educational institutions, and basic research.

2. In cases where the public sector is the eventual purchaser or funder of the output (e.g. national security, space), there is general agreement that the public sector has the major planning and funding responsibility but relies heavily on the private sector as the major performer.

3. In cases where the private sector (e.g. firms, consumers) purchase the outputs of innovation there is agreement on the clear responsibility of the private sector and much dispute about the role, if any, of the government. This is a major issue for current and future debate and resolution, and therefore will be the focus of much that follows.

Possible Rationale for Federal Involvement

There is persuasive empirical evidence (although surrounded by significant limitations) that R&D and technological innovation have had a significant positive effect on the economic growth and productivity increases in the U.S. An NSF review (2) by a number of leading economists who have conducted research on this subject concluded that:

"Although what we know about the relationship between R&D and economic growth/productivity is limited, all available evidence indicates that R&D is an important contributor to economic growth and productivity. Research to date seeking to measure this relationship (at the level of the firm, the industry, and the whole economy) points in a single direction—the contribution of R&D to economic growth/productivity is positive, significant and high."

The individual studies of the economic payoff from investment in R&D in the U.S. vary in their methodology and focus. Studies have been done at the level of individual innovations, individual firms, whole industries, and the national economy. Correlations have been made between R&D and productivity, and average and marginal rates of return have been calculated. For individual inventions, the rates of return, based on conservative assumptions, range from 10 to 50 percent. At the industry level, results have shown the following rates of return:

Chemical industry	30—50%
Petroleum industry	40%
Food, apparel and furniture	15%
Agriculture	35—170%
Selected other industries	15—55%

Turning to the U.S. economy as a whole, it has been estimated that average rates of return were in the range of 30 to 55 percent in 1966. The conclusion

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reached in this NSF review is that:

"*All* reasonable ways of looking at the matter lead to the conclusion that the rates of return are very high as compared to usual estimates of rates of return on capital formation."

Another major conclusion of this review is that:

"Based upon the evidence, good judgment would lead to the conclusion that the United States is probably underinvesting in civilian sector R&D from a purely economic growth/productivity point of view. However, nothing can be said, based upon this conclusion, as to where particular R&D investments should be made. What this judgment means is that there is good reason to expect that a well diversified incremental R&D investment will result in high payoffs similar in magnitude to those of the past."

There is general agreement on a number of reasons why the market mechanism by itself is likely to lead to an underinvestment in R&D from society's point of view. An investment in R&D involves a large element of risk—the more so as one approaches the basic research end of the spectrum. An individual firm, or industry, may not be willing to provide funds for so risky an activity. In addition, much of the benefit frequently accrues to other firms or industries or to society as a whole. Because the firm cannot appropriate many of the benefits flowing from the expenditures, it will be less likely to make such expenditures. Nevertheless, from the viewpoint of the country as a whole, such expenditures may be highly valued.

In addition to such theoretical underpinnings (termed externalities) we now have the beginnings of empirical measurements which seem to support the theory. A pioneering study of Professor Mansfield of the Wharton School, University of Pennsylvania, of 17 industrial innovations revealed great variability in the rates of return obtained from innovation, with a median rate of return to the firm (before taxes) of about 25 percent. Total median rates of return to society were twice as high as the private rates of return to the firm itself. Most important for public policy was the finding that a significant proportion of innovations produced very low private returns but high returns to society (3). This supports the externality theory and we are now in the process of independently replicating the results and broadening the number and types of cases.

I should mention, in passing, that inadequate venture capital does not appear to be a basic problem in the U.S. as frequently claimed by some observers. An in-depth review of what we know about this subject does not support the frequently stated contention that the U.S. Government must take action to increase the supply of venture capital to innovative activities (4). This is not to say that for some organizations (especially during downturns in the business cycle) venture capital problems do not exist. Rather it is to point out that in the U.S. this is not a general problem that is susceptible to government action.

Even though the research shows imperfections in the market mechanism from the social returns point of view, this does not necessarily mean that government action is warranted, efficient, or effective. In order to justify government action it is necessary to demonstrate that private returns are insufficient to call forth adequate investment in innovative activities and that proposed government policies and actions are cost/effective. In fact, the record to date of action by a number of different countries including the U.S. with regard to civilian technological innovation is replete with many failures and few successes (5). However, the noncapturability by the investing firm of some of the returns from innovation plus the much higher social than private returns does offer the major rationale for possible government action. What, if any, additional public policy and action would be appropriate in this area is a major issue to be resolved. The lack of a resolution of this issue at the present time is a major reason for the lack of specific implementing policies, although many have been suggested (6).

Effect of Federal Regulation

One area affecting technological innovation in which the U.S. Government has acted, frequently for other reasons, is regulation of business. It is therefore useful to review what we know about the effects of such action. In doing so it is helpful to separate two kinds of regulation: economic regulation and health, safety, environmental regulation.

There is evidence that on the whole, economic regulation has at a minimum a distorting, and at a maximum a negative, effect on technological innovation (7). No consensus exists as to whether health, safety, or environmental regulation has, on the whole, been beneficial or detrimental to technological innovation. There are examples of both kinds of results and good reason to believe that we should not expect general conclusions because of the differing forms of specific regulations and their varying effects (8, 9). One can, however, suggest a few reasonable guidelines for policy:

1. The less regulation necessary to meet specific objectives, the better.

2. The carrot (e.g. incentives) as well as the stick (e.g. disincentives) is generally a more effective approach than the stick alone.

3. The need to be sensitive to growing concern that an increasing amount of industrial R&D and innovation resources (both financial and manpower) are going for defensive regulatory purposes and being diverted away from offensive economic objectives. At some point diminishing returns in terms of the resource base for pursuing both private and public objectives may set in. But, whether or not the U.S. has reached such a point, or when it might, is open to great debate.

While patents are generally thought of as a positive incentive, they are nevertheless a form of regulation. The importance of patent rights for a firm's or industry's innovative activity varies significantly from firm to firm and industry to industry. The variance in the importance of patents may be due to the rate of technological innovation and existence of trade secrecy laws and practices (10).

Some have argued that relaxing antitrust regulations might promote R&D and innovations. The evidence indicates that small- to medium-sized firms conduct research more efficiently than large firms. Increases in firm size, beyond some intermediate size, do not appear to be especially conducive to increased R&D intensity. Medium- to large-sized firms, however, may offer economies of scale in later phases of innovation and are better able to exploit or develop R&D findings (11). The conclusion this and other research suggests is that while there may be reason to consider changes in antitrust policy, laws, and enforcement, R&D is not a significant factor for doing so (12).

Available evidence suggests that the U.S. should maintain its present policy of permitting technology transfer to other countries relatively free of restrictions despite pressure to the contrary. There is no evidence that on net balance, U.S. economic welfare (including employment) has been hurt, and much to indicate positive effects (13).

Let me conclude with my own judgment as to what I think are the major criteria or guidelines for public policy and practice:

1. Federal policy and practice regarding civilian sector R&D and technological innovation should be made more consistent with government economic and social policy.

2. Federal policy and practice should be more consistent over time and avoid constant change and uncertainties which discourage private investment and activities.

3. Wherever possible, federal policy and practice should reinforce and help perfect private market forces rather than substitute for them. There is a growing body of evidence that governments have a tendency to carry such activities too far or stay involved too long. This frequently leads to:

    a) Government R&D funding substituting for and discouraging, rather than complementing or encouraging, private investment;

    b) Interference with the positive market incentives when particular developments reach the commercialization stage; and,

    c) Government tends to push technology, which is usually less effective than relying more on market needs to pull innovation. As pointed out earlier, technology is not synonymous with R&D and the justification for government efforts designed to push the frontiers of knowledge does not apply to technological developments.

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WAINO W. SUOJANEN
STEPHEN BROOKE

> "The article treats a topic of great interest to us as a research organization. I personally feel we have not done an outstanding job of managing or even detecting creative people."
>
> T. B. Kinney, Jr.

The Management of Creativity

The creative process is perhaps the most personal and individualistic of all man's mental undertakings. Because of this, and because even the most articulate creative individual finds difficulty in describing to others the nature of the process, there would appear to be little hope of ever developing a theory which would provide guidance in the area of management of creativity. Creativity, no matter where it is found, appears to follow no fixed rules. It adheres to no formal patterns of logic. The creative process, in essence, is antithetic to almost all the principles on which current management theories are based.

In practice, the theory of the scheduling of invention is much more advanced than is the theory of the management of creativity. Many creative people, when questioned, argue that they *should not* be managed. Cynics claim that creative individuals *cannot* be managed. Dilettantes declare that managing creative people *is no different* from supervising shoe clerks, salesmen, or seamstresses. In the discussion which follows, we attempt to show that all of these views are incorrect. Further, we hope to prove that current theories supply inadequate guidance for managing creative people. Rather than offering modifications of existing theories, we offer a new management scheme which we feel provides both insight into the problems of managing creativity and guidance to those who serve in research management positions.

AUTHORITY RELATIONSHIPS AND CREATIVITY

The superior-subordinate relationship of the functional bureaucratic theory may be employed as a useful bench mark in determining

the extent to which this model must be modified or superseded to provide a desirable climate for creative work. It is evident that there are certain work situations in which the degree of direction exercised is much more authoritarian than that present in the superior-subordinate relationship. The opposite, of course, is equally true. An attempt to portray the gamut of these relationships is presented in Figure 1.

FIGURE 1

Comparison Between Work Relationships
and Degree of Authoritarian Control

Degree of Authoritarian Control	Work Relationship
Maximum	Owner-slave
	Custodian-inmate
	Lord-serf
	Officer-enlisted man
	Entrepreneur-worker
Median	Superior-subordinate
	Manager-employee
	Master-journeyman
	Engineer-technician
	Client-professional
Minimum	Patron-protégé

Source: This is an amplification of a classification appearing in B.F. Gordon and I.C. Ross, "Professionals and the Corporation," *Research Management* (Nov. 1962), pp. 493-505.

In the owner-slave relationship, the owner has all the power; he can use force to select ends and achieve means. Even in the armed forces of free societies, a similar relationship frequently exists between the officer and the enlisted man. The literature is replete with studies of custodial institutions in which conflicts occur over orientation: should it emphasize custodial or correctional goals?[1] These conflicts appear to be absent when a high degree of authoritarian control is accepted as the basic policy of the institution.

TOWARD A NUMBER OF MANAGEMENT THEORIES

Periodically, suggestions appear in the literature that the bureaucratic model does not apply to certain types of organizations.[2] The human relations model is often recommended as a substitute where creative or social tasks, instead of routine duties, are performed in an organization or in a component part of an organization.

A conceptual approach, differing considerably from the bureaucratic-human relations dichotomy, is presented in Figure 2. The superior-subordinate relationship, which occupies the median point insofar as the degree of authoritarian control exercised by the supervisor is concerned, appears opposite the routine-oriented type of organization.[3] Below it appears the manager-employee relationship characteristic of the human relations model. It is quite significant to the succeeding argument that this relationship also appears opposite the routine-oriented organization along with the superior-subordinate relationship of the bureaucratic model.

FIGURE 2

Spectrum of Authority Relating
Types of Organizations with Kinds of Work Relationships

Types of Phenomena	Work Relationship	Types of Organizations
1/1 Competition and Conflict		
1/0	owner-slave custodian-inmate lord-serf officer-enlisted man	(a) Crisis-oriented
Cooperation and Collaboration	entrepreneur-worker superior-subordinate manager-employee	(b) Routine-oriented
0/1	master-journeyman engineer-technician clinet-professional patron-protegé	(c) Knowledge-oriented
0/0 Confusion and Chaos		

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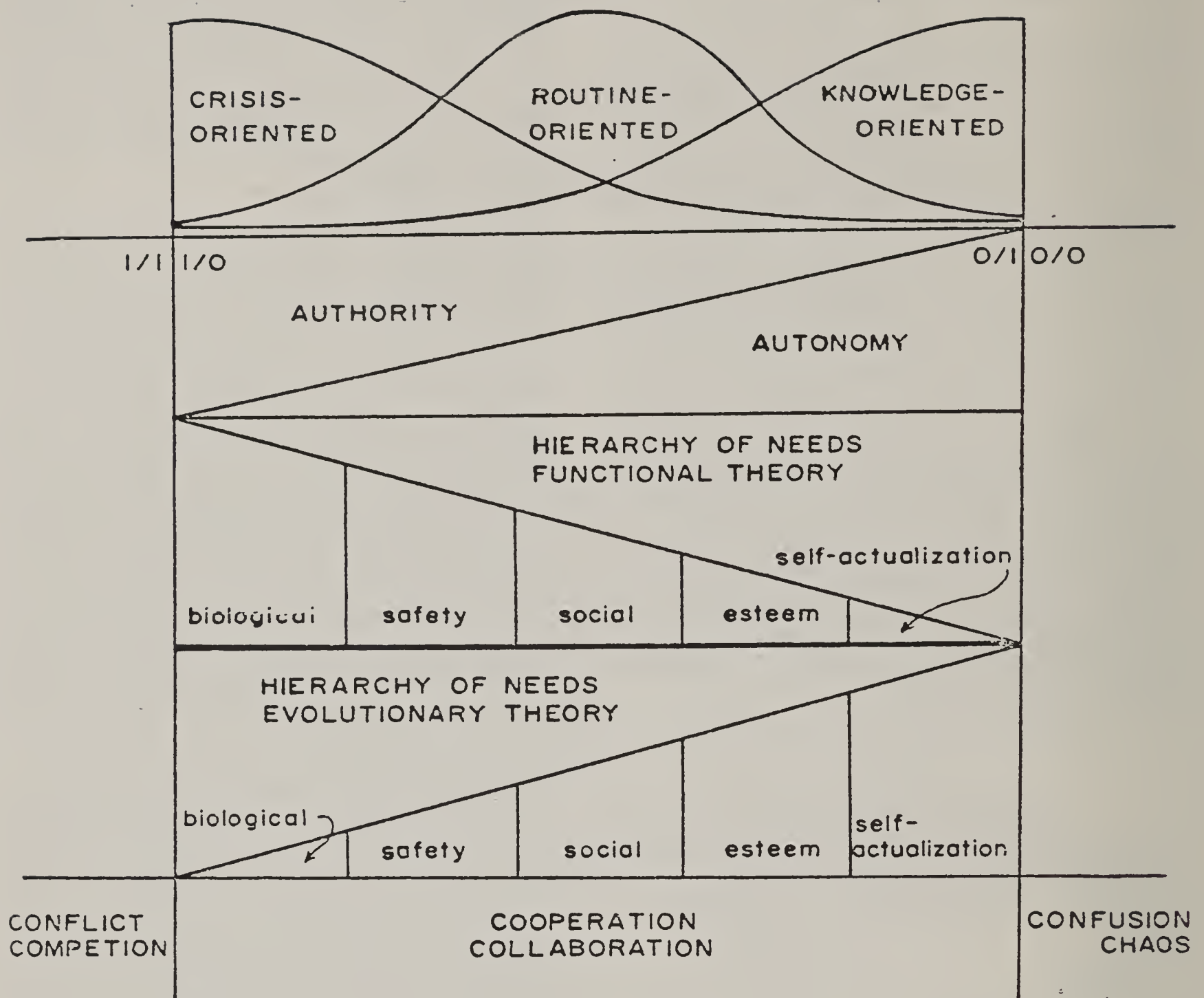
The literature of organization theory frequently misleads us with a continuum concept, having bureaucracy and human relations at opposite poles. Rather than a straight line, the theory of the creative environment is more like a tree, with the bureaucratic model representing the root and trunk on which human relations appears as a branch.

The failure of the bureaucratic and the human relations approaches, separately or jointly, to provide concepts useful in understanding the creative process, is based on several points. At the very heart of the bureaucratic model is a functional theory of biological, safety, and social needs. .These needs are prepotent in a poor and developing society, but this need orientation is of little value in explaining the motivational pattern of groups or individuals interested in satisfying the higher level needs of esteen and self-actualization. It is because creativity is most closely associated with esteem and self-actualization rather than with the lower level needs that an entire shift in emphasis is mandatory if we are to place creative activity properly into a management framework.

One way to develop a theory about the environment in which creativity will flourish is suggested by Figure 3. In Figure 3, all systems of cooperation or collaboration are classified as organizations. Cooperation in the crisis-oriented organization depends on power or the ability to apply force. The sanction behind collaboration in the routine-oriented organization depends on influence. In short, the main difference between the knowledge-oriented organization and the crisis- and routine-oriented organizations is that management should be governed by reason in the former, whereas rule by ascription or formal authority is more important in the crisis-oriented and routine-oriented associations.

Another way of viewing authority-autonomy relations is provided in the body of Figure 3. Within this area, cooperation or collaboration ranges from the 1/0 type of control characteristic of the owner-slave relationship to the 0/1 type of control which distinguishes the relationship between the patron and protegé. Thus, in the 1/0 system of collaboration the person in the position of authority actually exercises total command within the situation. The closest approach to a 0/1 type of situation is that between the patron and the protegé in which the subordinate has almost total autonomy in determining the decision.

FIGURE 3

CRISIS-ORIENTED   ROUTINE-ORIENTED   KNOWLEDGE-ORIENTED

1/1 1/0   0/1 0/0

AUTHORITY   AUTONOMY

HIERARCHY OF NEEDS
FUNCTIONAL THEORY

self-actualization

biological | safety | social | esteem

HIERARCHY OF NEEDS
EVOLUTIONARY THEORY

biological | safety | social | esteem | self-actualization

CONFLICT   COOPERATION   CONFUSION
COMPETION   COLLABORATION   CHAOS

From Figure 3 it is clear that between the polar extremes of owner-slave and patron-protegé, there exist a number of situations in which the weight in determining the decision is shared between leader and follower. For example, a .5/.5 relationship is one in which the leader and follower share authority equally. Such a relationship would be found in the exact middle. Within the area of cooperative activity, the sharing of authority between leader and follower may therefore fall anywhere in the continuum appearing in Figure 3, providing that the total is never greater or less than one.

In a competitive or a conflict situation, indicated by 1/1 in the left column of Figure 3, more than one organization is present. Each organization has its own system of authority and therefore does not exert hierarchical control over any of the others. Competing firms will, of course, interact on each other in the market place. In a similar way conflict will occur among organizations such as nations when they can find no peaceful way of arriving at solutions.

According to Figure 3, confusion or chaos will result in a 0/0 situation in which authority is either not present or is not exercised. This situation is illustrated by the right-hand column of the model. Despite the requirement that a considerable amount of autonomy be granted to the working participants of the creative enterprise, a certain degree of authority must always be exercised by the leader of the organization. If this responsibility for exercising authority is abdicated it is highly probable that a state of confusion or chaos will ensue. The creative or the knowledge-oriented organization may therefore be viewed as existing in a state of suspended animation somewhere between the 1/0 situation of an authoritarian bureaucracy and the 0/0 position of anarchy. Although this is another story, the

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model in Figure 3 provides insight into the continuing wave of student unrest on university campuses.

The Creative Misfit

It is most important to relate the various authority-autonomy relations (which exist within the area of cooperative activity) to the evolutionary hierarchy of needs. This type of analysis brings a dawning appreciation of the challenge presented by the creative individual. In contrast to the slave or serf or technician, the creative individual operates in an area of high autonomy and low authority. His drives are not directed at satisfying biological and security needs, but rather at the esteem and self-actualization levels.

Unless management techniques and theories are based on the satisfaction of the higher level needs, there is very little that can be done to outline a theory which applies to the management of creativity.

The creative individual does not fit comfortably (if at all) into the schemes associated with the bureaucratic model of management. Why?

The value system of the creative person—the basis for his decisions and upon which his behavior is predicated—is his own. He creates it to serve his own life. This value scheme is not a set of premises absorbed during the process of cultural osmosis, nor is it a type of value scheme based on some "other" or "higher" good. Rather, the creative person operates from within, employing his own life as the basis for his actions, and using his own methods of integrating his stimulus environment. Clearly, this approach to the world is radically different from that of individuals motivated by biological, safety, or social needs.

Given this internally generated value scheme, the more traditional value systems become superfluous and even harmful if imposed by authoritarian means. More often than not, this is the outcome when the creative individual is forced to operate within the tradition-directed and routine-bound framework of classical bureaucracy.

The creative person usually substitutes his own intuition and insight for orthodox thinking. A high regard for one's own subjective and creative talents is obviously basic to self-directed, autonomous activity. This reliance on personal intuition and insight is most apparent in the types of problems commonly tackled by creative thinkers. Such problems can be typically characterized as having a low probability of success as well as a high degree of risk.

Traditional thinkers place many problems in the low probability-high risk category after their orthodox and highly logical approaches have failed to produce a solution. The failure of traditional analytical techniques, however, seldom dissuades the innovative thinker. The creative individual approaches the problem, whatever it is, without worrying about the failures of others. Because he is not hindered or constricted by other approaches, he is free to tackle the problem using his own techniques and ideas, relying mainly on his own intuition and insight.

Attempts to explain the nature of the creative process continue to be the subject of concentrated psychological research. The creative process still retains many aspects of mystery to investigators in the field of human behavior and remains an enigma to most managers and administrators. Perhaps the best characterization of creative thinking (as opposed to other types of thought) is that presented by Edward DeBono.[4] DeBono bases his theory on the distinction between vertical and lateral thought processes. In essence, the vertical thinker, in solving a problem, digs a pre existing hole so much deeper; the lateral thinker, by contrast, digs a new hole.

The work of the creative individual (or lateral thinker) is not as easily monitored as that of the vertical thinker. Herein, of course, lies the major problem for management and management theory. The work of a technician or an applied researcher can be charted on a day-to-day basis. Progress, or lack of it, can easily be measured. Work is assigned and is carried out. Those involved in such exercises fit comfortably into the "company way of doing things" and usually, if not always, find it relatively easy to adapt and adjust to the demands of organizational policy.

But, the creative individual is *self*-directed. This self-direction is a natural outcome of his motivation by the higher drive levels of esteem and self-actualization rather than biological, safety, or social needs. It is neither surprising nor unpredictable that such individuals do not make good "company men." They find it quite difficult to fit into a uniform scheme—especially when that scheme involves detailed supervision of all aspects of work. The loyalties of the creative man are simply not directed to the company but rather to himself. In this respect he tends to be a cosmopolitan rather than a local.

The Creative Role

With these ideas in mind, we can now analyze

the role of the creative individual in the knowledge-oriented organization.

In Figure 2, the master-journeyman relationship is placed in the knowledge-oriented or type (c) organization. At first glance, this may appear somewhat incongruous. Yet, if "creativity" is substituted for "craftsmanship" and "creative person" for "worker or craftsman" in the following quotation, the reasons for inclusion become quite obvious.

Craftsmanship as a fully idealized model of work gratification involves six major features: There is no ulterior motive in work other than the product being made and the processes of its creation. The details of daily work are meaningful because they are not detached in the worker's mind from the product of the work. The worker is free to control his own working action. The craftsman is thus able to learn from his work; and to use and develop his capacities and skills in its prosecution. There is no split of work and plan, or work and culture. The craftsman's way of livelihood determines and infuses his entire mode of living.[5]

The idealized virtues of craftsmanship developed by Mills have been criticized as departing far from reality. Granted the validity of such comments, the master-journeyman relationship, nonetheless, implies a far greater degree of freedom of working action on the part of the follower than is present in the normative, superior-subordinate relationship of the routinized bureaucracy.

The knowledge-oriented organization is, in many respects, amenable to the same type of analysis that has been applied to craftsmanship. Moreover, as indicated in Figure 2, the range of autonomy permitted the follower in the knowledge-oriented organization may sometimes be extremely wide. Thus, at one end, the leader-follower relationship in the knowledge-oriented organization approaches the superior-subordinate relationship of the routine-oriented organization. This occurs as knowledge moves closer and closer toward practical application. Thus, development engineers tend to identify much more closely with production engineers than do scientists engaged in basic research. Understandably then, the management techniques associated with production and development engineers must differ from those of their more creative colleagues since the two tend to operate at different drive levels and to respond to different systems of rewards and gratifications.

One way of analyzing the knowledge-oriented organization is to break it down into its component elements. This has been done in Figure 4 by a matrix which classifies fundamental research, applied research, and research management by the various dimensions which, in a broad sense, separate one from another.

FIGURE 4

Differences Among Segments of Knowledge-Oriented Organizations

Dimension	Fundamental Research	Applied Research	Management of Research
Occupational Prototype	Scientist	Engineer	Manager
Type of Function	Restructuring and accumulation of knowledge	Accumulation and conversion of knowledge	Understanding and appreciation of knowledge
Degree of Structure	Program building	Highly programmed	Program directed
Genesis of Elite	Creative intellectual	Highly-achieving studious	Social leader
Needs Satisfied (Drive Level)	Self-actualization Esteem	Esteem Social	Social
Supervisory Pattern	Influence	Authority	Force
Management Technique	Reciprocity and/or complete autonomy	Reciprocity, field control	Field control, command
Conformity	Low	Medium	High
Uncertainty	High	Medium	Low
Leader-Follower Relationship	Patron-protegé Client-professional	Engineer-technician Master-journeyman Manager-employee Superior-subordinate	Manager-employee Superior-subordinate

Pure research stands at the apex of the value hierarchy of the knowledge-oriented organization. It provides the "professional" model with which many participants in knowledge-oriented organizations strive to identify. Little does it matter that the nineteenth century, real-world roles of the college professor and the independent general practitioner of medicine, upon which the model is based, have been overwhelmed by organized research and specialization in this century. Because tradition dies hard, this ideal pattern still retains its strength and continues to be perpetuated on a daily basis in every graduate school in the country.

To a large extent, basic research today is being advanced most rapidly by specialists working together in groups of varying sizes using highly expensive apparatus and equipment. It remains true that pure and profound scientific discoveries remain largely the product of creative individuals, yet the interdisciplinary approach comes

into its own in basic research. To malign interdisciplinary research is much in vogue these days. Nonetheless, future advances in basic research will remain dependent on this device to an even greater extent than has been the case in the past. Thus the problems associated with the management of creativity are compounded by the requirements of coordination imposed by large scale, interdisciplinary research. Science and technology are so important to our society, and the problems to be solved are so complex, that the number of students enrolling for graduate work increases every year.

Those students with a definite materialistic bent seem to prefer such fields as law, medicine, and business administration in which the prospective financial rewards are high. These are, to a large extent, the "social leaders" studied by Drews.[6] Creative intellectuals and high-achieving studious individuals by contrast, tend to prefer graduate work in the sciences and to a lesser extent engineering, the social sciences, and the humanities.

In graduate school, the student is constantly exposed to a faculty value system in which fundamental research stands at the apex of the knowledge-oriented organization. Furthermore, each student is required to earn his spurs by total immersion in his discipline. This exposure is finally capped by a thesis or dissertation which is judged on the basis of the contribution that it makes to knowledge. As the fortunate recipients of a graduate degree, the successful ones plunge into the world fully hoping to make their own personal contribution to the store of knowledge.

Many of those who have successfully completed their graduate work within the relatively autonomous environment of the university undergo a traumatic experience when they first enter industry. They quickly discover that individual aspirations and organizational goals are seldom congruent.[7] The industrial laboratory must stress applied research to develop profitable products. The dream and the desire to do basic research disappear in time as the senior colleague-junior colleague ideal of graduate school fades into the background to be replaced by a more realistic manager-employee relationship. This enables the organization to achieve its objectives better; but the participant may pay the cost in terms of not being able to achieve his esteem and self-fulfillment needs and may make a less-than-maximum contribution. This frustration appears to be less for engineers than for scientists.[8]

THE MOVEMENT INTO MANAGEMENT

Marcson distinguishes four types of career goals among scientists in industrial laboratories.[9] These four categories can be fitted into the matrix provided in Figure 5.

FIGURE 5

Matrix of Motivations of
Scientists in Industrial Laboratories

Creatively Economically	Satisfied	Unsatisfied
Satisfied	A	C
Unsatisfied	B	D

The largest proportion of scientists and engineers falls into category A: they are both creatively and economically satisfied with their role in the applied research hierarchy of the industrial laboratory. In the course of their careers they become adjusted to the reality that their future lies in applied rather than fundamental research.

Many scientists or engineers falling into the B, C, and D categories sooner or later move into management. The D category engineer recognizes early in the game that the fiction of the patron-protegé or client-professional model does not fit the industrial laboratory mold. This type of technical person moves into management when he is comparatively young and, in almost every way, adjusts rapidly to the manager-employee or superior-subordinate mode.

The B category scientist often devotes the early years of his career to successful and productive research. However, economic rewards in management are perceived as being greater than those in the laboratory and sooner or later this type of man makes the transition to adminstration. There is rather wide agreement now that creative productivity reaches a peak somewhere in the 35 to 55 age bracket. As a result, we can assume that the B category scientist may be a highly successful manager of creative people. Having once been in a position to satisfy his own esteem and self-actualization needs, he should tend to develop considerable empathy with younger people who are similarly motivated. This sense of empathy, however, may be offset by a lack of training in, and perhaps even appreciation of, the tools and techniques of modern management.

The C category provides a universally applicable

model. Every individual who becomes a scientist or engineer cannot expect to make contributions equal to that of the average. Internally, at least, many will be dissatisfied because they do not feel they are living up to their own creative expectations. The management route therefore is viewed as desirable.

CONCLUSION

A number of dimensions must be kept in mind if our theory of the management of creativity is to keep in step with both the growth in human knowledge and the urgency to apply this knowledge to all of the multifarious social problems of our day. The evolutionary theory which emphasizes the prepotence of the higher needs is replacing the functional theory which assumes that men are motivated by satisfying the lower level biological, safety, and social needs.

The superior-subordinate relationship in the routine-oriented organization is the real world referent of the model that is visualized when bureaucracy is discussed. This relationship is undoubtedly what some have in mind when they argue that the supervision of creative scientists is no different from supervising shoe clerks or salesmen or seamstresses.

Some would argue that although uniform and routine tasks are better analyzed by the bureaucratic model, the nonuniform, nonroutine tasks requiring creative or social skills are better described by the human relations model. It should be obvious that the human relations model which has proved to be inadequate in the routine-oriented organization cannot provide anything more than peripheral guidance to the improved management of the knowledge-oriented organization.

Our analysis suggests that a number of dimensions must be kept in mind if the management of creativity is to keep pace with the growth of human knowledge. Careful study indicates that the climate in which creativity flourishes is in many respects quite different from the accepted hierarchical and human relations models of management. Management is the best allocation of scarce resources, of which the scarcest is creative human talent. One of the most important management opportunities of our time is to identify this creative talent early in life, to educate it to its maximum potential, and to provide it with the environment in which it can make its greatest contribution to the growth of human knowledge.

FOOTNOTES

1. Mayden N. Zald, "Power Balance and Staff Conflict in Correctional Institutions," *Administrative Science Quarterly*, 7 (1962), 22-49; Donal R. Creasey, "Contradictory Requirements in Complex Organizations," *Administrative Science Quarterly*, 4 (1959), 1-19; Oscar Grusky, "Authoritarianism and Effective Introdoctrination: A Case Study," *Administrative Science Quarterly*, 7 (1962), 79-95; Oscar Grusky, "Role Conflict in Organization: A Study of Prison Camp Officials," *Administrative Science Quarterly*, 3 (1959), 452-472.

2. For instance, see Richard H. Hall, "Intraorganizational Structure Variation: Application of the Bureaucratic Model," *Administrative Science Quarterly*, 7 (1962), 295-308, and Warren G. Bennis and Philip E. Slater, *The Temporary Society*, (New York: Harper and Row, 1968).

3. See Waino W. Suojanen, *The Dynamics of Management* (New York: Holt, Rinehard and Winston, 1966), 108-110.

4. Edward DeBono, *New Think* (New York: Basic Books, 1968).

5. C. Wright Mills, *White Collar: The American Middle Class* (New York: Oxford University Press, 1956) 220.

6. Elizabeth M. Drews, "The Four Faces of Able Adolescents," *Saturday Review*, 19 (Jan. 1963), 68-71.

7. Simon Marcson, *The Scientist in American Industry* (New York: Harper, 1960), 51-64.

8. *Ibid*, 58-60.

9. *Ibid*, 65-70.

RE: "Developing Managers..."
"A good reminder of human nature regarding learning. Also, a good reminder that there is no substitute for 'experiencing'."

H C Cox

Developing Managers Without Management Development

SAUL W. GELLERMAN

"Development," as used here, is the learning that occurs independently of instruction. It is primarily the result of experience. Whether it carries the individual very far beyond what he was taught depends partly on his learning capacity, but more importantly on the quality of his experience and on whether he is encouraged to learn from it. In the present review I also want to point out that:

- Whether an organization succeeds in assuring its supply of competent managers depends far more on how it runs its business than on the sophistication, or even the use, of formal training programs.

- Four specific aspects of the organization's management of itself are the keys to both the quality and quantity of its future talent supply. These are: organization structure, job design, career planning, and control systems.

- Formal management training programs are neither necessary nor sufficient for this purpose, although they can significantly strengthen the organization that uses these four tools effectively.

- The process of developing subordinates can be anxiety-provoking for executives, and this, rather than the inherent difficulty of the process, is the principle obstacle to its wider use. S.W.G.

M ANAGEMENT is essentially a set of skills involving the application of certain principles. The principles can be taught to or inferred by the individual, but their application can only be learned. I can teach you the principles of swimming, but you will not learn to swim until you get into the water and find your own way of using those principles. Similarly, management principles can be taught, but the only way of learning to use them is by trying to manage.

Large organizations have obvious advantages over smaller ones with respect to formal "management development" programs. They have larger training budgets, can more easily spare managerial time for course attendance, and are usually more sophisticated in selecting both potential managers and course materials. However, smaller organizations have no disadvantage with regard to structuring themselves so that development is likely to occur. Thus there is no reason why a company that cannot afford large-scale investments in *training* its managers need despair of *developing* them.

This article sets forth a general strategy for encouraging the development of managers. It is based on certain principles which must be understood if it is to be used effectively. Accordingly, the principles are stated first:

Principle 1: Fighting Human Nature Is a Losing Game

The conditions under which development is likely to occur are known and it is largely futile to expect much development to occur in the absence of those conditions. Basically, this means that the work that managers are assigned to must be instructive in itself, and that their superiors must be charged with exploiting the instructional potentialities that present themselves in the normal course of that work. On the other hand, formal instruction of the classroom variety—even when competent and pertinent—provides little incremental skill when there is no immediate opportunity to practice what is taught.

Principle 2: Development Occurs as the Response to a Challenge

Our attention is naturally drawn to our own attempts to cope with a problem, and the lessons in those attempts impress themselves naturally upon our memories. In the absence of problems demanding solution our attention ordinarily wanders, and the results of those wanderings seldom add much to our store of knowledge. As a rule we learn only when we have to; that is, when a satisfactory response to the situation in which we find ourselves is not already within our repertoire.

This principle has two important implications:

Very little development can be expected simply because people desire it. Therefore attempts to develop managers by selecting people with a strong personal drive to expand their managerial skills, or by encouraging such a desire with inspirational messages, are likely to have limited success at best.

Very little development can be expected to occur on a convenient schedule. Most promotions are timed to meet the organization's needs rather than the individual's growth rate. As a result, many promotions occur after the individual has passed his peak of readiness. Similarly, the principles taught in training courses are most likely to be applied if opportunities to do so occur shortly after they are taught. But courses are usually scheduled at the convenience of the training department and managers are released for training at the convenience of their superiors. Thus the relationship between the timing of training and opportunities to practice it is usually random.

Principle 3: Development Is More Like Farming Than Manufacturing

In manufacturing we assume that most of the variables affecting the result we wish to achieve are, or can be put, under

our control. In agriculture we assume that few of these variables are, or can be, under our control. In manufacturing our strategy is to design a system with all the appropriate controls we need. In agriculture it is to influence those few variables we can control as much as we can in hopes that nature will be reasonably cooperative with all the other variables. Thus the plant manager can, for example, control temperature and humidity if he needs to, but the farmer can only pray for the right amount of rain.

The organization that wants to develop its managerial talent is in fact much closer to the farmer's situation and is better served by his strategies. Its objectives, therefore, are simply to create conditions in which good men are likely to grow naturally, and then hope that they will. This is a disappointing formula for those who perpetually hope to get results by "doing something"; but surely there is a lesson for us in the fact that so many of the "somethings" we have done to develop managers have turned out to be fads.

The manufacturing approach to developing managers is characterized by four emphases which can be summarized alliteratively: *select* them, *school* them, *slot* them in the right jobs, and *show* them your appreciation with appropriate rewards. The assumption is that the right kind of talent, when exposed to this treatment, will develop; and, of course, sometimes it does. But the yield of this "4-S" approach is limited when it is not adequately reinforced by opportunities to learn from experience.

What follows is a description of an essentially "agricultural" approach: creating conditions in which learning from experience is likely to occur. It is not offered as an alternative to the manufacturing approach where that is in use, but rather as a vital supplement. The agricultural approach can stand by itself, where necessary, in organizations where size or budgetary limitations preclude sophisticated selection and schooling methods. The basic idea is to so construct the organization that it becomes, in effect, a talent farm.

Organization Structure

The number and content of jobs, the number of levels of decision-making authority, and the division of projects into assigned responsibilities—in brief, organization structure—is inevitably an expression of management's assumptions about how the talent available to it is best utilized. Once embedded in that structure, those assumptions tend to become self-fulfilling prophecies. Both job performance and personal development are limited to the confines of the experiences provided within the structure, and this evidence is taken as confirmation of the wisdom inherent in its design. Therefore, changes in organization structure are hard to induce because they generate their own (sometimes spurious) appearance of inevitability.

With respect to development, organization structure can be confining or liberating. The confining effect is usually unintentional and unrecognized, because structure is seldom designed with developmental consequences in mind. But if the organization pursues development as a serious goal, its structure should be designed to be liberating: to encourage experiences from which useful learning can be derived.

The ideal structure for developmental purposes is a small, self-contained unit requiring little or no external support, which has an undivided responsibility for the attainment of some major organizational purpose. The more the unit to which the individual is attached conforms to this "task force" form, the more likely is he to encounter experiences from which he can learn; unfortunately, the obverse is not only true but more common. Functional organization—that is, centralizing work of a given type in specialized departments regardless of which major project that work applies to—may have certain advantages, but development is not one of them.

The task force is in effect a miniature version of the larger organization of which it is a part. But its internal communication lines are much shorter, permitting faster response and easier checking to be sure that messages are understood. The small task force develops managerial generalists because it can afford no specialists. Lacking depth in any given function, they more than compensate for that by showing through direct, everyday experience how actions taken in one part of the organization enhance or inhibit actions taken in other parts. The parochial regard of each function for its own work, to the comparative disregard of the organization's larger purposes—so common and so damaging in large, functionally specialized organizations—hardly has a chance to develop in a task force.

Service in such a task force provides the manager with what is in effect a one-man organization development program. He learns—or rather, can learn—that most essential of leadership skills: the fine art of making other people effective. By contrast, his colleagues in a larger unit are more likely to encounter the wall of misunderstanding and sheer ignorance that functional organization builds between an organization's components. He is far less likely to develop the view that other components are unwise or unnecessary or both: a view that would not serve him well should he ever be elevated to top management levels.

Another advantage of the smaller unit is that everyone is near the top, which virtually eliminates the problem of unrecognized talent. The two major obstacles to talent recognition in a large organization—visibility and sponsorship—are obviated. The ability of the organization to identify its more promising managers early in their careers is maximized. An added plus is that job performance is likely to loom larger than personal attractiveness in winning such attention, since individual contributions are more readily identified in a task force than in a larger organization.

Task force organization is more feasible than it may at first appear. Many profit (or cost) centers are essentially moves in this direction, as are product management groups. Dependence on central staffs for scarce or expensive specialists can be minimized through the matrix organization approach, which in this case would have two or more task forces sharing the services of such specialists. The old shibboleth that no one can work effectively under more than one boss has been effectively punctured by demonstrations that task force leaders who talk to and trust each other can share otherwise prohibitively expensive specialists.

In fact, the principle limit on the feasibility of task force

organization is management's readiness to depart from tradition. By breaking the large pyramidal organization into what is in effect a loosely linked network of small pyramids, even organizations of substantial size can become hothouses of managerial development at little or no sacrifice of operating efficiency.

JOB DESIGN

We ordinarily think that the job of a job is to get the work that is assigned to it done, and we therefore design jobs with solely operational objectives in mind. But jobs have another job, which is the development of their incumbents. The proportion of managerial jobs whose primary function is development should increase at every level of authority and should reach 100% no lower than the level immediately below the chief executive.

A job stimulates development when some of its responsibilities have *not* been mastered. This is why the prescription of many executives for the development of their subordinates for the coming year—"more seasoning in his present position"—can easily be a fallacy. It is also why investigative, trouble-shooting, consulting, or teaching assignments can be among the most significant developmental experiences in a man's career.

Jobs contribute to the development of their incumbents under certain conditions, and it is to the advantage of the organization to create those conditions:

First, the individual has not yet mastered the job, and he knows this.

Second, mastery of the job is within his capabilities, and he has enough optimism to at least hope that this may be true.

Third, achieving that mastery is more likely to lead to new learning opportunities than to long spells of practicing what was long since mastered, and the individual knows this, too.

This reasoning runs contrary to conventional wisdom in two respects: one is the problem of what to do about managerial *mistakes*, and the other concerns the desirability of developing *experts*.

One of the tacit principles underlying the design of most jobs is the avoidance of errors. This is done both by excluding responsibilities that even approach the limits of the incumbent's abilities, and by a system of checks through which superiors review—and presumably detect any errors in—a subordinate's work. Obviously, to design jobs so that they are not mastered is to court errors.

In practice, however, errors may go undetected for months or even forever, simply because thorough checks of a manager's work are seldom feasible. Also, the evaluation of many managerial decisions (especially when their consequences may take months or years to unfold) is necessarily subjective. Whether it is an error or a farsighted coup may depend, in other words, on who does the evaluating and on when he does it. In sum, errors are not necessarily easy or even desirable to avoid.

A case can even be made in favor of errors. Nothing is quite so instructive, chastening or memorable as the error from which one is encouraged to learn, rather than to hide. The consequences of most errors are less than catastrophic—unless they are made dangerous to careers, in which case they are likely to accumulate insidiously with other hidden errors.

What happens to executive control when jobs are designed to be at least partially unmastered, and errors are the basis for instruction rather than punishment? Obviously, it changes; but it certainly isn't dismantled. The fine line between putting the organization in jeopardy and precluding the development of the manager is approached less timidly than it usually is. Some risks are costlier when not taken.

A good analogy for defining how much control is "enough" comes from skiing. To ski in control means to be able to stop if necessary. To manage in "enough" control means to know enough of what a subordinate is doing to be able to prevent truly catastrophic errors. The rest are the subordinate's problem—and his opportunity to learn. In evaluating the subordinate's performance, the superior is more concerned by any recurrent errors than with the number that occur once. Indeed, an absence of errors in an unmastered job is cause for alarm: the subordinate may be sticking too timidly to the rulebook to learn anything but the rules.

The desirability of experts is a hardy old fallacy that is likely to linger on, more because it satisfies emotional needs than because of major benefits to the organization. An "expert," if there is such a thing, is someone who knows his job too well to make an error, and he presumably acquires his expertise through long service in the same job. In other words, he first masters his job and then overlearns it, ad infinitum, until he can do his work flawlessly without even thinking about it.

That, of course, is the fallacy. Long service in an essentially unchanged job is likely to lead to thoughtlessness, blindness to new developments and resistance to change. In the absence of the necessity to learn, most people just stop learning. This doesn't mean that we must rush someone off to a new job the moment he masters his old one. Even if that were feasible, we can safely reap the rewards of our training investment for a while—but not indefinitely.

The emotional needs that experts satisfy are those of the executives whose policies create them, not those of the experts: first, a bogus sense of security, as if one were really surrounded by infallible lieutenants; second, an easy rationalization for keeping a man where he is when it would be inconvenient or risky to move him.

Finally, that entire class of jobs that has too long been misnamed "trainee" should be overhauled and, in many cases, abolished. Many management trainee jobs have actually been little more than holding pens for overqualified coolies. They are given routine chores because no one knows quite what to do with them, and because it is presumed that "learning the business from the ground up" will do them no harm. But the experience of being a coolie prepares one for nothing grander than being an older coolie.

For someone with management potential, orientation to the basics of an enterprise can and should be accomplished briskly. The only real management trainee—in the sense of someone who is learning to manage—is someone in a managerial job.

Career Planning

While it is obviously fatuous to attempt to plan anyone's career very far into the future, it is equally fatuous not to do so for the forseeable future. In the case of managers, this usually extends into the three-to-five year range. Somewhere within that period it will probably be desirable to introduce some major modification into the manager's job, because within that period he will probably master his present job and return an ample dividend on the organization's training investment.

It is also obvious that most of those modifications cannot be promotions, in the sense of giving the manager authority over more assets and/or people than he previously had. Fortunately, development can proceed without promotion. (Although not without reward: pay and status indicators should signal the successful closing of a career phase and entry into a new one.) The modification can be the addition of a new responsibility, the replacement of old responsibilities or even a complete change of responsibilities.

The aim is always to confront the manager with a new learning opportunity. In a larger sense the aim is to convert the management team to a learning group and to convert the managerial career into a license or mandate to learn. Responsibilities are deliberately shifted among jobs or sought in hitherto untried activities. This kind of ferment occurs willy-nilly in a rapidly growing company and actually helps to accelerate its growth: a beneficent circular relationship develops between organizational and individual growth. But even in static or slowly growing firms the process of redistributing responsibilities can be deliberately *managed* to encourage the blossoming of careers.

Sometimes the main reason for denying a developmental opportunity to a promising manager is that it is already "taken" by someone else who is performing adequately and has no immediate prospects of promotion. This raises the delicate, and therefore seldom-faced, question of whether the organization "owes" a managerial job to anyone, and if so whether first-come-first-served is the most appropriate principle to apply. The problem is especially acute in closely held or family owned companies, in which the roles of ownership and management are often commingled.

If the organization is committed to ensuring its supply of managers by developing them internally, it must regard managerial jobs as learning opportunities; and in that sense it cannot "owe" them to anyone. No cut-and-dried formulas are possible here, but there clearly will be occasions when a manager whose performance has been adequate will be asked to relinquish his responsibilities to someone who can benefit from the learning opportunity inherent in that job. Such changes are made immeasurably easier if the organization has established (or if necessary, decreed) a policy of "tours of duty" for middle and top level jobs.

This concept is already well-established for overseas management assignees and for military officers. Relief from the assignment marks the end of the incumbent's expected contribution to it and the completion of what he undertook to do: there are no implications of failure. The concept has much to

recommend it. But its implications for top management must be faced squarely: a tour of duty system is viable only in a reasonably fluid organization in which managers relieved from one job are accommodated in vacancies created by relieving still other managers. Insistence by top executives on retaining their own assignments indefinitely retards the flow of reassigned managers below them and can even render the entire system ineffective. The tour of duty concept may, in other words, make inevitable the confrontation between the long-range interests of the organization as a whole and the individual interest of its leaders.

Development is not easily bought.

Control Systems

In a traditional organization the control function of a superior is to make sure that his subordinates are doing their jobs as it was planned that they should be done. This responsibility is not abandoned when the organization accepts the responsibility for enhancing the development of its managers; but the emphasis upon it is brought into balance, with an emphasis on seeing to it that subordinates are learning from their jobs.

In practice this means that the subordinate's decisions are discussed, rather than prescribed or proscribed; and that while the superior will offer advice upon request, he is more likely to be alarmed than flattered by an excess of requests. Both the superior and the subordinate managers have new roles to learn if the latter is to grow into something more than a carbon copy of the former.

Learning new roles is never easy, but it is easier when the

"If you Want to Teach a Boy to Swim . . ."

An experience in my Army days makes its lesson vividly, although I was not to appreciate its significance until many years later. I entered military service as a rather self-important, overeducated second lieutenant in the Medical Service Corps and was assigned directly to a large hospital. After a few days I was summoned by the executive officer at 5 o'clock in the afternoon. As I stood at attention before his desk he regarded me with evident disappointment, sighed, began to put on his coat, and barked out a series of rapid-fire orders:

"See the armband on my desk, lieutenant? Put it on your left arm. That makes you administrative officer of this hospital. You're in charge until 0800 tomorrow morning when I'll be back. There are several hundred patients here, some of them seriously ill. There are more than a thousand assigned military personnel, and several million dollars' worth of government property. Take care of anything that comes up and don't call me unless the Russians attack. Good night."

"But, sir!" I spluttered.

"Something wrong, lieutenant?"

I gritted my teeth, suppressed my anger and managed to say, "Sir, I'm new in the Army."

"Oh?" said the executive officer, in mock surprise. "Do you mean that *you* don't know how to handle the job?"

I could cheerfully have committed some grave breach of military etiquette at that point, but the temptation passed and I could only admit mournfully, "That's right, sir."

"Well, in that case, lieutenant," said the executive officer, "if I were you, I would learn how to do the job in a hurry. There's a manual on my desk. Good night."

I did not have much opportunity to read the manual that night, because the telephone began to ring almost immediately after he left. I was swept up so quickly in decisions, issuing and receiving reports, and the other minutiae of a routine but to me completely new job that I forgot my resentment at the way I had been thrust into it. Next morning I considered myself quite an expert on administration and had, without knowing it, taken my first faltering steps on the long road to a certain administrative competence. Much later I got to know the executive officer fairly well and was deeply impressed by his ability to determine the training needs of junior officers. It turned out that he wasn't ordinarily curt and sarcastic at all. He reserved that treatment for arrogant, young, second lieutenants.

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individual sees more clear-cut advantage for himself if he does learn from it. For this reason it must be noted that superiors are not only more likely to find their new roles more difficult to learn—because there is less personal advantage in it for them than there is for their subordinates—but that the reluctance of superiors to adapt themselves to a coaching/controlling role will inevitably inhibit the development of many subordinates.

The process of conversion from controlling roles to coaching/controlling roles is subtle, delicate, and too easily frustrated by undersupport or sabotage. Paradoxically, the process itself needs to be controlled if it is to be effective; and the key to that control is the tour of duty system. A manager who cannot be relieved when his tour is completed because an adequate replacement is not available has clearly failed to develop his subordinates. The same is true of managers to whom presumably developable subordinates are assigned, but who persistently fail to provide adequately developed replacements to other departments.

Such failures raise serious doubts about fitness for top-level positions, since similar failures there can choke the entire development system. Further, whatever financial rewards are used should surely be more liberal for those managers whose subordinates are judged by *subsequent* superiors to be well-prepared than those whose subordinates are judged otherwise. A system of appropriate retroactive rewards should not be beyond our ingenuity. The main function of a reward is to

emphasize what the organization considers important; and when development is rewarded only by lip service, the clear implication to most managers is that development isn't really important.

In the long run an organization is better served by leaders who have learned to cope with anxiety than those who have merely learned how to avoid it. Anxiety is inherent in the development process for superior and subordinate alike. The superior consciously risks the errors of his subordinate, while the subordinate shoulders full accountability for decisions that are at least partially new to him. Anxiety, like old-fashioned medicines, is unlikely to be enjoyable, but it can be beneficial. It is seldom disabling. If it is, it should be read as a clear signal that the individual is ill-equipped (at least for the present) to participate in his own or anyone else's development.

MANAGEMENT STYLE

Some organizations attract, hold and develop capable managers without being overly concerned with courses, seminars, audio-visual materials, and the like. Whether by design or luck, they have managed to create an environment in which good men can grow.

In itself this is no reason for curtailing formal management development programs. But the ultimate yield from our investment in those programs depends much less on their content than on what the company's own style of management permits its managers to practice. To shop around for the "right" course or the "right" consultant is futile if what is taught cannot be effectively applied to, and reinforced on, the job.

In the end, life itself is our most potent teacher. If it is so organized as to be constrained, repetitive and safe, it will teach us to ignore opportunities and shun the unknown.

If it is so organized as to be challenging and risky, life will teach us to adapt to change and to evaluate the potential payoff in risk. The way in which an organization manages itself today is, willy-nilly, the classroom in which its next generation of managers acquire both the vision and the blindspots with which they will meet the future.